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THE NOTION OF PROBABLE ERROR IN ELEMENTARY STATISTICS[1]

WHAT I have to say to-day is not addressed to professional mathematicians or statisticians. To mathematicians and statisticians all that I shall say is already entirely familiar. There are two other classes of readers, however, to whom I hope the discussion may be of service: (1) the rapidly increasing number of laymen who, without technical mathematical training, are constantly coming upon such terms as "probable error" in their general reading, and (2) the non-mathematical research worker who is constantly tempted to embellish his numerical results by adding an imposing array of "probable errors"—obtained, alas, too often by the simple process of substituting blindly in a formula. (A formula, of course, is an essential tool; what will concern us here, however, is the underlying significance of such a formula, and the necessary limitations surrounding the proper use of it.)

What are the principles that lie behind the common use of the term "probable error"? What does it really mean when we say, for example, that a quantity x has an estimated value of 3.6 with a "probable error" of 0.2 (written $x = 3.6 \pm 0.2$)?

The conventional reply to this question will occur to all of us—namely, that "the probable error is the error that is as likely as not to be exceeded." For example, if $x = 3.6 \pm 0.2$ the conventional understanding is that the "true value" of x is as likely to lie outside the limits 3.4 and 3.8 as it is to lie between those limits.

But this conventional reply does not go very far behind the scenes—we should like to have something more fundamental. Under what circumstances can we properly speak of errors as "equally likely" to occur? What are the fundamental considerations underlying the whole range of ideas which are suggested by the term "probable error"? I believe the best modern opinion is in favor of treating the so-called "probable error" from the point of view of empirical statistics, with as little reference as possible to the technical theory of probability; and I am convinced that much misunderstanding will be avoided if we can keep as

[1] Address of the retiring vice-president and chairman of Section A (Mathematics), American Association for the Advancement of Science, Nashville, Tennessee, December 29, 1927.

far away as possible from the older language of probability.

A. ERRORS OF MEASUREMENT

The earliest use of the term "probable error" which I can discover is in a paper by Bessel in 1815. Bessel, following some then recent methods of Gauss, was discussing a problem in the adjustment of measurements of an unknown quantity. Let us begin, therefore, with a brief outline of the problem of *adjustment of measurements*. This problem is conveniently treated under two headings, first, the "probable error of a single observation" and secondly, the "probable error of the mean."

I. *The "probable error of a single observation"*

Suppose we have before us a large number of measurements of an unknown quantity; suppose next that we take the arithmetic mean of these measurements; and suppose further that we compute the deviations of the given measurements from the mean. If the number of measurements is large many of them will coincide exactly with the mean value; and among those which differ from the mean, small deviations will occur more frequently than large ones.

If now we lay off the values of the given measurements along an axis of abscissas, and at each point of this axis erect an ordinate which shows the number of times that the corresponding measurement occurs, we shall have a *frequency diagram* or *distribution diagram* for the given set of measurements. The area of the diagram (or, rather, the area divided by the smallest recognized interval along the axis) will be equal to the total number of measurements in the set. The actual form of the diagram for a given set of measurements is a matter of experience. In a large number of cases, however, the distribution is found to conform to what is known as the *normal law of error*, represented by the familiar bell-shaped curve whose equation can be found in any book on statistics. If the measurements are closely consistent with each other, most of the deviations from the mean will be small and the distribution curve will be sharply peaked; if the measurements are less consistent—that is, more scattered—the curve, though of the same area, will be flatter.

The question at once arises: how shall we secure some estimate of the consistency of the given set of measurements? One method for doing this is as follows: we may divide the area of the distribution curve into four equal parts by ordinates erected at the points $x=-r$, $x=0$, $x=+r$, where x is measured from the mean; the value r will then have the property that just half of the deviations from the mean will lie between $-r$ and $+r$. This value r is called, after Galton, the *quartile deviation* of the given set of measurements, and may obviously be taken as an indication of the consistency of the measurements; the smaller the quartile deviation the more closely packed are the measurements about their mean.

By an unfortunate use of language, for which Bessel and Gauss are chiefly responsible, this quartile deviation is commonly known as the "probable error of a single observation," for the given set of measurements. This term "probable error" is here used in a highly technical sense and does not mean at all what it would appear to mean in ordinary language. It is best interpreted as merely an obscure synonym for the clearer, almost self-explanatory, term quartile deviation. The important thing to note is that the "probable error of a single observation," in spite of its name, is not a property of any single measurement, but a property of the whole set of measurements; it enables us to say, not that any single item is more accurate than another single item, but that one whole set of measurements is more consistent with itself than another whole set of measurements. The term is used chiefly in statements describing the precision of an instrument, or the precision of some measuring process. It is not often used as the ± 0.2 that one sees annexed to numerical values.

This, then, is the first common use of the term probable error; the so-called "probable error of a single observation" means merely the quartile deviation of the given set of measurements; it serves to indicate the self-consistency of the set of measurements, or the peakedness of the distribution diagram.

II. *"The probable error of the mean"*

The second common use of the term "probable error" is in the phrase "probable error of the mean." The conventional explanation of this phrase runs somewhat as follows: suppose we have a given set of n measurements, conforming to the normal law of distribution, and having a definite mean and a definite quartile deviation. Next, let us *pretend* that we have also a large number of similar sets of measurements of the same quantity, making k sets in all, each containing n measurements; and consider the k means belonging to these k sets. These means will constitute a sort of super-set of k values which will have its own distribution diagram, its own mean and its own quartile deviation. By a subtle application of the theory of probability, the quartile deviation of this super-set is proved to be equal to the quartile deviation of the original set divided by the square root of n; and this value is what is called the "probable error of the mean," for the original set.

This conventional explanation leaves much to be desired. What is the use of pretending that we have a

"super-set" composed of "a large number of sets of measurements similar to the given set" when we have in reality only one set to work with? And why should the quartile deviation of this hypothetical super-set be of any significance in the problem of measurement?

When one examines the actual use that is made of the so-called "probable error of the mean" one finds that it is almost always associated with *the problem of combining several sets of measurements,* with a proper "weight" attached to each set. In the practical solution of this problem there is no question of a hypothetical super-set of imaginary sets of measurements; all the sets of measurements with which we are concerned are actually given. Two illustrations will make the practical method clear.

First, suppose we have two normal sets of measurements of equal consistency, one containing ten measurements, the other twenty. In combining these two sets of measurements it is natural to give the second set twice as much weight as the first, since the number of measurements in the second set is twice as great as the number of measurements in the first. The combined mean or "weighted average" of the two sets will then be the mean of the first set plus twice the mean of the second set all divided by three. The justification of this process of computing the weighted average of two such sets lies in the fact that it gives exactly the same result as if we had taken all thirty measurements as a single set of measurements and found the mean of this set in the ordinary way.

Secondly, suppose we have two sets of measurements containing the same number of items, but having unequal consistency. Suppose for example that the quartile deviation of the first set is $r_1 = 3$, and the quartile deviation of the second set is $r_2 = 4$. Before combining these two sets of measurements, we must first reduce them, so to speak, to a common denominator. To accomplish this we may make a photographic enlargement of both diagrams, until the quartile deviation of each is equal to the same number, in this case 12. This step is justified by the natural assumption that two distribution diagrams which are similar—that is, one merely an enlargement of the other—are of equal weights. Here, in the case of the first diagram we multiply the linear dimensions by 4, and therefore the area by 16; and in the case of the second diagram, we multiply the linear dimensions by 3, and therefore the area by 9; the position of the mean in each case being unchanged. The quartile deviation of each diagram is now equal to 12, so that the two revised sets of measurements are of equal consistency and can be combined by the method just described. Remembering that the area of a distribution diagram is proportional to the number of measurements, the first set must be given a weight of 16, and the second set a weight of 9. The weighted mean will therefore be equal to 16 times the first mean, plus 9 times the second, all divided by 25.

It is easy to show that the same result would have been obtained if we had multiplied the first mean by a weight equal to $(1/r_1)^2$, and the second mean by a weight equal to $(1/r_2)^2$, and divided by the sum of these weights.

The extension of this process to the combination of the two cases: namely, to the case of several sets of measurements which differ not only in consistency but also in the number of measurements in each set, presents no difficulty. We are thus led at once to the following general rule for combining any number of sets of observations which are normally distributed: *the weight to be attached to each set is directly proportional to the number of measurements in that set and inversely proportional to the square of the quartile deviation of the set.*

I hope that this brief sketch of the practical method of combining sets of measurements will make it clear that the whole subject can be presented without reference to anything except what is immediately given by the actual measurements; it is not necessary to bring into the discussion any hypothetical super-set of imaginary sets of measurements or to make any use of the technical theory of probability. The ± 0.2 placed after the numerical statement of a mean value is commonly called the "probable error of the mean." This is a quantity obtained by dividing the quartile deviation of the given set of measurements by the square root of the number of measurements in the set; it is best regarded as merely a conventional way of indicating one step in the computation of the weight which should be attached to the given value when this value is to be combined with other values of a similar nature. It is not necessary to think of it as something mysteriously connected with the theory of probability.

It is interesting to note in passing that there is another measure of the consistency of a set of measurements, which is coming more and more into use. This is the *standard deviation,* or mean square error, introduced (under the name "mean error") by Gauss in 1821. The standard deviation is the square root of the mean of the squares of all the deviations from the mean; in the case of the normal curve it proves to be simply the abscissa of the point of inflection (measured from the mean). For this curve, as is well known, the standard deviation, σ, and the quartile deviation, r, are connected by the relation $r = 0.6745\sigma$, and the ordinary method of computing the quartile deviation is first to compute the standard deviation directly from the given measurements, and then to multiply by 0.6745. The quartile deviation (or "prob-

able error") is thus about two thirds as large as the standard deviation (or "mean square error"), in the case of the normal curve.

A pretty quarrel has arisen as to which of these two quantities is the handier one to use as an indication of the consistency of a set of measurements. Gauss himself began in 1816 with the exclusive use of the probable error. In 1821 he uses the mean square error and the probable error side by side. By 1828 he begins to speak of the probable error as the "so-called" probable error; and a few years later he is quoted as saying: "the so-called probable error, I, for my part would like to see altogether banished." In 1889, Francis Galton, the grandfather of the British school of statistics, condemns the term probable error in vigorous language. "It is astonishing," he writes, "that mathematicians, who are the most precise and perspicacious of men, have not long since revolted against this cumbrous, slip-shod, and misleading phrase." Many recent writers like R. A. Fisher agree that the fact that the use of the probable error is common "is its only recommendation." On the other hand, Professor Mansfield Merriman (1884) regards the probable error as the most natural unit of comparison and insists that it alone should be used and the mean square error be discarded. At the present time both the probable error (or quartile deviation) and the mean square error (or standard deviation) are so thoroughly established in the literature that neither of them is likely to be given up.

Let us now leave the subject of errors of measurement and pass on to another use of the term "probable error," namely, its use in connection with the subject of random sampling—a subject which is coming more and more to occupy the central position in the whole modern theory of statistics.

B. Random Sampling

In the problem of errors of measurement, the final result desired is the value of a single unknown quantity, and the distribution diagrams of sets of measurements of the unknown are merely means to an end. In the problem of random sampling, however, the final result desired is the distribution diagram itself.

For example, a shoe manufacturer wishes to know what demand he may expect for various sizes of shoes. He wishes to know, for example, what proportion of the population wears a number eight shoe. What he needs is a distribution diagram of the foot-sizes of the whole population. This distribution diagram will exhibit, of course, a certain mean value; but this mean value is not now the interesting thing; and the deviations from the mean, instead of being errors to be avoided, are now important for their own sakes. The distribution diagram itself is the thing that is wanted. Now the distributions that occur in practice are by no means always of the normal form; a frequency diagram may often be "skewed" in one direction or the other; it may be more sharply or less sharply peaked than the normal curve of the same area and same quartile deviation; or it may even be of a U-shaped form, with the large deviations from the mean more frequent than the small ones.

In order to describe a distribution diagram concisely we may state the values of four parameters, two of which we have already mentioned: (1) the mean; (2) the standard deviation, that is, the square root of $1/n^{th}$ of the sum of the squares of all the deviations from the mean; (3) the third moment, that is $1/n^{th}$ of the sum of the cubes of the deviations from the mean; and (4) the fourth moment, or $1/n^{th}$ of the sum of the fourth powers of the deviations from the mean.

The standard deviation, as we have seen, gives a measure of "dispersion" or "scatter." (If the distribution happens to be symmetrical, either the standard deviation or the quartile deviation may be used as a measure of dispersion; but in the general case the standard deviation alone is available.) The third moment leads to a measure of "skewness." The fourth moment leads to a measure of what Pearson calls "kurtosis." Any given distribution diagram is sufficiently characterized for most purposes by giving the values of these four parameters; the mean, the standard deviation, the third moment, and the fourth moment.

Let us suppose then that our shoe manufacturer desires to study the distribution of foot-sizes in the whole population of a hundred million people. He obviously will find it impracticable to measure the whole population, so that he can not obtain the parameters of the distribution directly. He therefore takes a sample of a moderate number, n, of people, chosen, as we say, at random, and determines the parameters of this sample. The question is, what conclusion can be drawn about the mean, standard deviation, etc., of the total population from a knowledge of the mean, standard deviation, etc., of a single sample?

This question is being actively discussed at the present time, and all that I can do here is to indicate briefly the nature of the answer that may be hoped for. Suppose, for example, that the parameter in which we are interested is the mean. Consider the totality of all possible samples of n which can be drawn from the population in question. The number of such samples will of course be enormously large, but can be readily computed by the theory of permutations and combinations. Each sample of n will have its own mean; and the set composed of the means

of all the samples will be distributed in a perfectly definite way, depending on the nature of the total population.

Thus, it has been proved that the mean of the set of means will coincide with the mean, m, of the total population; the standard deviation of the set of means will be equal to $\sigma/\sqrt{n}$, where σ is the standard deviation of the total population; and the other moments of the set of means can be computed in terms of the corresponding moments of the total population. That is, if we assume any hypothetical values for the parameters of the total population, we can theoretically compute the parameters of the distribution of the means. Then by a subtle analysis, we can make a comparison between the distribution of the means and the observed properties of the given sample, and thus construct a test of the validity of our assumed values.

The result of such a test is commonly recorded in this form: the required mean, m, is equal to the observed mean, a, of the measured sample, plus or minus a "probable error" r. This indicates merely that if we had the totality of the means of all possible samples of n before us, 50 per cent. of these means would lie between $a+r$ and $a-r$. This use of the term "probable error" is unsatisfactory, however, since the distributions involved in the analysis are usually not symmetrical; the "standard deviation" is the more useful concept. Moreover, there is no special sanctity attached to the arbitrary choice of "50 per cent"; other ranges are often needed.

Moreover, the formulas commonly given for computing the probable error of the various parameters are only approximations which are not valid unless the original distribution is normal, and the size of the sample is large. The serious study of this whole question, for the general case of skew distributions and small samples is a product of the last two decades—one might almost say of the last two years. Some of the names associated with this study are Karl Pearson, R. A. Fisher, Tchouproff, and especially a learned British scholar who conceals his identity behind the modest pen-name of "Student." Exciting new developments are constantly appearing in *Biometrika* and similar journals; the most modern tools that mathematics can supply as, for example, the theory of integral equations, are called into play; and the very latest results are immediately put to use by practical statisticians of the Bell Telephone System and other great industrial concerns. The work is by no means completed, and even the exact nature of the answer that may be hoped for is not yet entirely clear.[2]

[2] For further information the reader is referred to H. L. Rietz's Monograph on Mathematical Statistics (Open Court Publishing Company, 1927).

A splendid field for research is opening up, the fruits of which are sure to be not only of the greatest theoretical interest but also of the highest practical utility.

EDWARD V. HUNTINGTON

HARVARD UNIVERSITY

THE GENERAL RADIATION[1]

THE impacts of electrons against atoms produce two different kinds of radiation, (a) the line spectra and (b) the general radiation, sometimes called the continuous, or white, spectrum. The general radiation usually carries a far greater amount of energy than the line spectra—hot body radiation, for instance. This is true of the X-ray region of the spectrum as well as of other regions. Although X-ray spectrum lines are often strongly marked and sharply defined, the general radiation contains more energy than the lines, for it covers a much greater range of wave-lengths. In the evolution of recent thought, however, less attention has been paid to the general radiation than to the line spectra, partly because the line spectra have important bearings on our ideas as to atomic energy levels. In this address, I wish to present to you the more important characteristics of the general radiation, as they have been discovered by about twenty men, carrying on researches in different parts of the world. Time will not permit a detailed account of the subject. These details may be found in the text-books, which contain numerous references to the original articles published by the investigators.

On account of the fact that homogeneous beams of high-speed electrons can be produced, accurately controlled and measured, and because each electron has a relatively large amount of energy, the X-ray region of the spectrum provides us with a better field for investigating general radiation than do other regions.

The curve representing the distribution of energy in the general X-radiation spectrum as a function of the wave-length resembles that for the spectrum of black body radiation. There is one important difference between the two, however, namely, the general radiation spectrum has a sharply defined short wave-length limit. The quantum theory explains this limit quantitatively and qualitatively; for the electrons striking the atoms of the X-ray tube's target can not have kinetic energies greater than the product of the electron's charge into the difference of potential through which it has fallen (namely, Ve). Therefore, the hν value of the quanta of radiation produced can not be greater than Ve. Strictly speaking, if we apply the laws of the conservation of energy and momentum to the impact of an electron against an atom, we find that the value of

[1] Address of the vice-president and chairman of Section B (Physics), American Association for the Advancement of Science, Nashville, Tennessee, December, 1928.

$h\nu$ can not be quite equal to that of Ve, as required by the quantum equation; for the electron must, in general, transfer some of its momentum to the atom, and the atom will, therefore, retain at least a small amount of the electron's kinetic energy. The corresponding correction term that must be subtracted from Ve in the quantum equation contains the ratio of the mass of the electron to that of the atom as a factor. It is, therefore, very small, so small indeed that it can not be detected experimentally—at least in the case of heavy atoms. If it turns out that the impacts of protons against atoms, or of atoms against atoms, also produce general radiation with short wave-length limits, it may be possible to detect and verify the correction term.

The short wave-length limit of the general radiation does not appear to depend upon the angle between the direction in which the X-rays travel and that of the stream of electrons which produced them. The limit is also independent of the substance composing the target of the X-ray tube. It depends only upon the maximum voltage through which the electrons fall.

By measuring the voltage applied to an X-ray tube and the frequency of the short wave-length limit of the general radiation, we get an experimental value for the ratio of h to e. Using the accepted value of e, 4.774×10^{-10} we find for the value of h, 6.556×10^{-27}. Some recent determinations of h by means of spectroscopic analysis, using Bohr's formula for the Rydberg constant, give values that differ from the above by only a very small fraction of one per cent. The accuracy of the two methods is about the same.

The general radiation extends from the short wave-length limit toward longer wave-lengths, reaching a maximum of intensity at a certain point, the exact position of which depends upon experimental conditions. After making corrections for the absorption by the matter through which the X-rays pass and for the reflecting power of the crystal grating, it has been found that, at right angles to the electron stream, the maximum intensity of a beam, unaltered by transmission through matter, occurs at a wave-length approximately fifty per cent. longer than the short wave-length limit. The position of the maximum, however, depends slightly upon the angle between the X-rays and the electron stream. The maximum point shifts towards the short wave-length limit as this angle decreases.

The total intensity radiated in the general radiation spectrum has been measured both by means of its ionizing effect and also by means of its heating effect. It has been found that, other conditions remaining the same, the total intensity increases almost exactly as the square of the voltage applied to the tube. Since the energy of the electrons increases as the first power of the voltage it appears that the *efficiency* of production of X-rays, also, increases as the first power of the voltage, in other words, as the first power of the energy of the electrons. It is interesting to note that this is an energy law, for the measurements have been carried up to such high voltages that the relativity correction for the kinetic energy of the electron becomes important. At the highest voltages used the kinetic energy of an electron exceeds the value of $\frac{1}{2}mv^2$ by as much as twenty per cent.

The total intensity of the general radiation measured by ionization methods increases with the atomic number of the chemical element composing the target. Where the order of atomic weights of the chemical elements differs from the order of their atomic numbers, the intensity of the radiation follows the order of the atomic numbers. The intensity is nearly proportional to the first power of the atomic number, there being a small, positive correction term proportional approximately to its second power. This means that the probability that the impact of an electron against an atom will produce general radiation does not depend upon the atom's *mass*, but upon the nuclear charge or the number of electrons in it.

General radiation is partially polarized. In terms of the electro-magnetic theory of radiation, the electric vector at a point is a maximum in the plane containing the stream of electrons that produce the radiation. The amount of polarization appears to increase as we approach the short wave-length limit of the general radiation spectrum. This agrees with the ideas contained in the classical theory of radiation, and with the idea that, in impacts of electrons against the solid target, the radiation near the short wave-length limit is produced by electrons that have not lost much energy, or had their directions of motion changed much, before they actually produce the radiation.

The way in which the intensity of a small portion of the general radiation spectrum of breadth 6λ varies with the difference of potential through which the electrons fall has been examined. The relation between the intensity and the applied voltage seems to obey very well a certain, somewhat complicated, equation. From the experiments performed in solving this problem, it has been deduced theoretically that the general radiation from an indefinitely thin target should have a maximum at the short wave-length limit and should fall off beyond this limit (toward longer wave-lengths) in the inverse ratio of the square of the wave-length.

Until recently experiments on the general radiation have been performed with solid targets only. Although the line spectrum of a liquid mercury target has been observed, there do not seem to be any observations on the general radiation from a liquid target.

Presumably such general radiation would have the characteristics of the radiation from a solid target.

Experiments have recently been made on the radiation coming from the impacts of electrons against gas atoms at low pressures. In these experiments, a stream of mercury vapor in a mercury pump passed down through a metal anode joined to earth and electrons, after falling through a constant difference of potential, passed through a hole in the anode and struck the mercury atoms. The radiation coming from these impacts through suitable openings has been examined. It has been found that the radiation at right angles to the stream of electrons has an average, or effective wave-length only a few per cent. longer than the short wave-length limit of the radiation as calculated from the quantum theory. In these experiments, the voltage applied to the tube was not sufficient to produce the L series lines of the mercury. This effective wave-length lies nearer the short wave-length limit than would be expected, if the intensity of the radiation fell off from the limit as the inverse square of the wave-length.

A number of interesting theories have been proposed in order to explain the characteristics of general radiation. Soon after the general radiation spectrum had been analyzed by means of crystal spectrometers, various assumptions were made as to the probability that an electron's impact against an atom would produce radiation and how much energy would be radiated. It was found that, by using the quantum theory and proper assumptions, a theoretical curve could be drawn which represents, at least roughly, the distribution of energy actually observed in the spectrum.

Another theory has been based on the application of Bohr's correspondence principle to the radiation, calculated on the classical theory for an electron approaching a nucleus. It gives the distribution of energy in the general radiation spectrum coming from an indefinitely thin target. This theory does not explain the short wave-length limit of the spectrum. It is arbitrarily assumed that the spectrum will be cut off at the short wave-length limit determined by the quantum theory. The theory predicts that beyond the limit, toward longer wave-lengths, the intensity of the general radiation will fall off approximately as the inverse square of the wave-length. The theory contains, also, an estimate of the total energy radiated, which appears to be of the right order of magnitude.

No solution of this problem by means of the theory of wave mechanics has been published. When such a solution is published, it will be interesting to see whether it explains the short wave-length limit of the spectrum and gives the same value for it as that deduced from the laws of energy and momentum applied to the production of a light quantum, and, further, whether it gives the correct distribution of energy in the spectrum of radiation from solid and gas targets.

At present, there does not seem to be a complete theory of the fundamental radiation problem, namely, that, if we allow an electron having a certain kinetic energy to impinge against an atom, shortly afterwards something of the same order of magnitude happens in a neighboring atom. From the point of view of theories, therefore, we are obliged to content ourselves with the application of the laws of energy and of momentum to the production and absorption of light quanta. These laws, as applied to the individual impacts of light quanta against electrons, have had extraordinary success in predicting and explaining that great discovery, made in America, which we call the "Compton Effect," and which we owe to the ability of our present chairman.

I can not allow the annual address of the retiring chairman of Section B to be delivered this year without commenting, also, upon a second great discovery, the selective reflection of electrons by crystals, the details of which Dr. Davisson will describe to us in a few minutes. Some years ago, in order to explain the reflection of light quanta by gratings and similar phenomena, a theory was proposed according to which the corpuscles transfer momentum to the grating in quanta. The magnitude of these quanta equals h divided by the grating space. It was shown that the law of quantum transfer of momentum accounts for those phenomena which we class under the heading of Fraunhofer diffraction.[2] If we introduce into the theory a quantity, λ, defined by the relation that λ equals h divided by the momentum of a radiation corpuscle, the equations of the theory take precisely the forms of those derived from the theory of the interference of waves, in which λ is the wave-length. Soon after this theory was proposed, discussions arose as to whether other forms of corpuscular radiation might not obey somewhat the same laws as those governing the diffraction of light quanta. It was suggested that radiation consisting of moving electrons, moving protons and even moving atoms ought to be reflected from gratings at least approximately in accordance with the laws of grating reflection. The ideas contained in the theory of wave mechanics seemed to offer an explanation for such reflections. There is, however, one possible difference between the theory of the transfer of momentum in quanta and the theory of wave mechanics. According to the theory of the transfer of momentum in quanta, the corpuscle should lose at least a small amount of its momentum and energy on reflection. It might lose much more on account of some electrical disturbance it produced, the ionization of some atom, for instance. The equations for the reflection of a corpuscle by a crystal grating that represent the

[2] The explanation of Fresnel diffraction seems to require further assumptions.

quantum transfer of momentum in three rectangular directions may be written:

$$mv\alpha - mv^1\alpha^1 = n_1\frac{h}{d_1}$$
$$mv\beta - mv^1\beta^1 = n_2\frac{h}{d_2}$$
$$mv\gamma - mv^1\gamma^1 = n_3\frac{h}{d_3},$$

The d's represent grating spaces, the Greek letters direction cosines and the n's whole numbers, in which v^1, the velocity of the corpuscle after reflection, may differ from v, its velocity before reflection. If v^1 is equal to v and if we put $\lambda = h/mv$, the above equations reduce to those derived from the theory of wave motion. If we look at the phenomenon of reflection of corpuscles from the point of view of the elementary wave theory, we may suppose the corpuscle to be replaced by a series of plain waves having a definite wave-length and we may suppose that these waves excite oscillations in the atoms of the grating which send out secondary waves. The interference of these secondary waves produces the reflected or diffracted beam. On this theory we would expect the frequency of vibration of the diffracted beam to be the same as that of the primary beam. We would expect, therefore, that the diffracted corpuscle would have the same energy, momentum and velocity as the corpuscle had before diffraction. It has been found, however, in the experiments which Davisson and Germer described in the December *Physical Review* that the reflected electron in general has less energy after reflection than before and that the loss of energy may amount to as much as twenty-five per cent. The fact that they observed electrons with such losses of energy appears to be explained by the above momentum equations as due to the sizes of the slits in their measuring apparatus.

No general solution of the equations representing the wave mechanics as applied to this problem has as yet been found. It may be that a general solution of the equations would indicate some loss of energy and momentum on reflection. If so, it will be interesting to see whether the angles at which reflection takes place are the same as predicted by the above momentum equations. According to these momentum equations, if the corpuscle loses a certain definite amount of energy, it must be reflected at certain definite angles from the crystal grating.

Although no completely satisfactory theory has been proposed for the radiation problem in general, it may be that we are gradually approaching a solution of it. A number of interesting physical theories have been proposed in recent years. A physical theory, however, does not represent what we might call real truth. A physical theory is a collection of fundamental hypotheses and general laws, which may be used to deduce particular laws that can be applied to concrete facts. Physical theories are useful, if they explain a large number of facts in simple ways, and if they furnish definitions of terms and a nomenclature to be used in describing phenomena. Physical theories are tools and not creeds, but one is at liberty to believe they represent reality, if one wants to. The belief in a physical theory, however, is a similar process of thought to the belief in religious tenets. The greater the number of useful physical theories that are proposed, the greater the number of good tools we shall have at our disposal, to use in discovering the real truth about the way in which nature acts; for it is the way in which nature acts that is the prime object of physical research. The multiplicity of theories in physics to-day really represents a healthy growth.

WILLIAM DUANE

HARVARD UNIVERSITY

FUNDAMENTAL SCIENCE AND WAR

MUCH has been said and written about war's effect on civilization; much has been said and written about war's effect on applied science and modern invention. Indeed the two are almost inseparable for the "degree of civilization of a people is commensurate with the extent to which they accumulate, correlate and utilize knowledge."[1] It is now universally realized that applied science progresses only after the foundation stones of pure science have been firmly laid. The process of laying this foundation consists in searching out, correlating and classifying knowledge. It is of this process that the layman is hardly aware, except that he knows it is carried on to a great extent in the academic world, in the laboratories of our colleges and universities. What would happen to civilization if this process were to cease? Is this process a continuous one? Is it affected by political influences? What is the effect of war on this apparently endless task?

It is the purpose of this paper to discuss the effect of the great war on one of the fundamental sciences —chemistry. In America we feel that chemistry is making great strides. We agree, and rightly, with Calvin Coolidge, who, in addressing the American Chemical Society on the White House lawn on April 24, 1924, said in part: "Wherever we look the work of the chemist has raised the level of our civilization, and has increased the productive capacity of the nation." We feel that the war caused an awakening in chemistry in this country. What its effect has been

[1] J. Alexander, Preface of "Colloid Chemistry" (1926).

TABLE I

Year	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Total number references	118	124	127	92	96	93	73	110	155	196	230	374
Non-U. S. A.	91	91	82	48	42	35	26	61	67	78	116	158

elsewhere we seldom ask; nor do we often find a satisfactory gauge with which to measure effects of this kind. It is hoped that the method of investigation chosen by the writer will serve as such a gauge to answer this question for the world as a whole, and more particularly for Germany, England and the United States.

Research in fundamental science is of little or no value to the progress of a nation unless it is more or less widely disseminated among scientific men, so that they may use the results to strengthen the structure which they are attempting to build. This dissemination usually is carried out by publication in the journals of scientific organizations. If we page through the current chemical publications we find that an investigator is giving us continually citations to previous work of former investigators. It is by studying these citations that we can answer the question which we have set for ourselves. If we choose the most representative publication of American chemistry, the *Journal of the American Chemical Society,* we find that in the last complete volume, 1926, there are reported the results of 459 separate investigations in pure chemistry. The writers of these reports give us 4,857 citations to previous work. These references are to 247 different periodicals and the international scope of science is manifest when one sees that there are represented journals from almost every civilized country in the world.

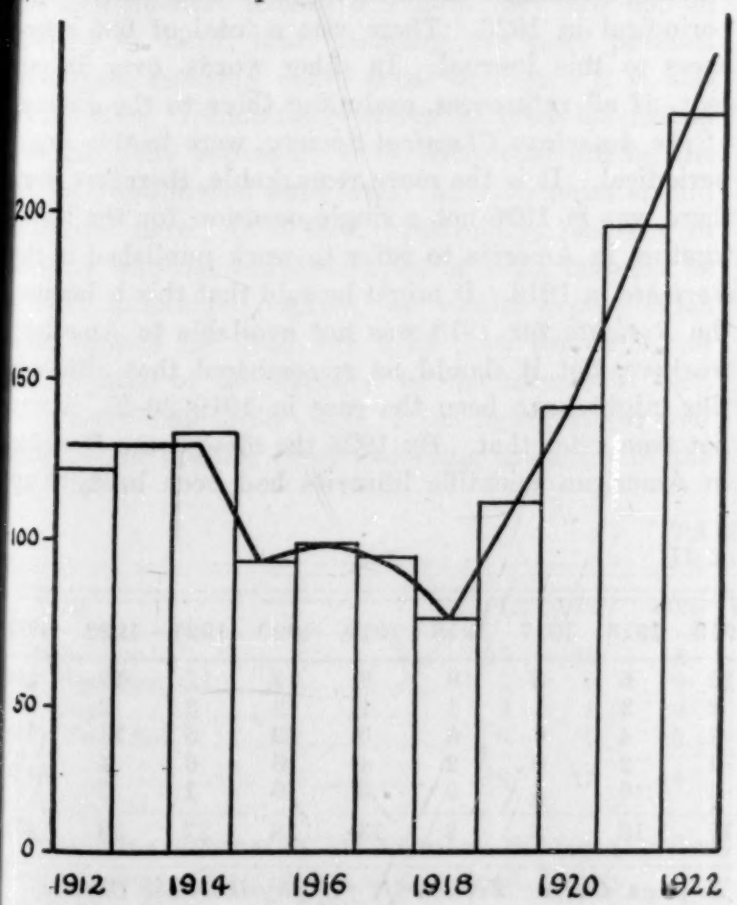


FIG. 1

If we first tabulate the references to articles published from 1912 to 1923, inclusive, according to the year of publication but without reference to the specific country of origin the results in Table I are obtained.

In Figure 1 we have graphically represented the first row of figures. The solid line is not supposed to represent a continuous functional relationship but serves only to show the trend of results from year to year. It will be seen at once that there is a marked decrease in the number of references to articles published in 1915 when compared with the practically static level reached in 1912, 1913 and 1914. We must conclude that there was indeed a falling off in the amount of research in chemistry successfully completed in 1915.

It must be remembered that there will be quite naturally more references to the years immediately preceding the year of publication (1926) of the articles from which the citations have been taken. We should also expect the slope of the "trend-curve" to become greater the nearer we approach 1926. It is because of this difficulty of deciding what might be called "normal behavior" that the years following 1923 are omitted from consideration. Undoubtedly, however, this effect is noticed in the high figure for 1923 and possible also to some extent in that for 1922. That this is true will be seen when one considers that much of the work published in 1926 in the *Journal of the American Chemical Society* was completed and submitted for publication in 1925. Conditions under which academic work is carried out make it highly probable that many of the researches were begun in 1924. In a sense, then, 1923 is very recent as far as literature citation is concerned.

Consideration of the method of investigation here employed will show that we are concerned not merely with the quantity of work published during this period (1912–1923), but that in reality we are concerned only with the good work, the work which has survived and which has proved of value to the investigators who followed. The method, therefore, has a distinct advantage over any method which counts pages or number of papers published in various journals for its basis of comparison.

If we examine the trend-curve in Figure 1 more closely we find an increase to a maximum in 1916–17. A maximum, to the chemist, at once suggests compound formation. In this case it would indeed seem to indicate a compounding of two results: a decrease in one country coupled with an increase in another, the latter becoming more rapid than the former in 1916. That this is actually the case will be shown in the subsequent analysis.

In Figure 2 we have represented in a similar manner the references to articles which originated outside of the United States. Here we see the falling off in 1915 is even more marked and continues in 1916–17 (instead of rising again as in the previous figure), finally reaching a minimum in 1918. It will be argued by some that research was carried on but was not published during this period because of prohibitive costs and general unsettled conditions in Europe. There are two answers to this objection. In the first place, it has already been pointed out that unpublished research is not completed research, because dissemination of knowledge is essential to scientific progress. Secondly, the trend-curve actually shows that some of this research was published in 1919 and 1920 after hostilities had ceased. If we consider what would be normal recovery from the minimum reached in 1918 we must conclude that the trend-curve should increase in slope with time; it should be concave upward. The dotted line in the figure indicates such a normal recovery curve. The actual curve is, however, decidedly convex. In other words, if we were to choose 1921 as a temporary standard, the number of references to articles published in 1920 and 1919 is too large. The cross-hatched section of these columns is meant to represent the excess over normal recovery. This then is thought to represent research completed during the war but not published until later. This effect will also be found to an equally marked extent in the curves which follow.

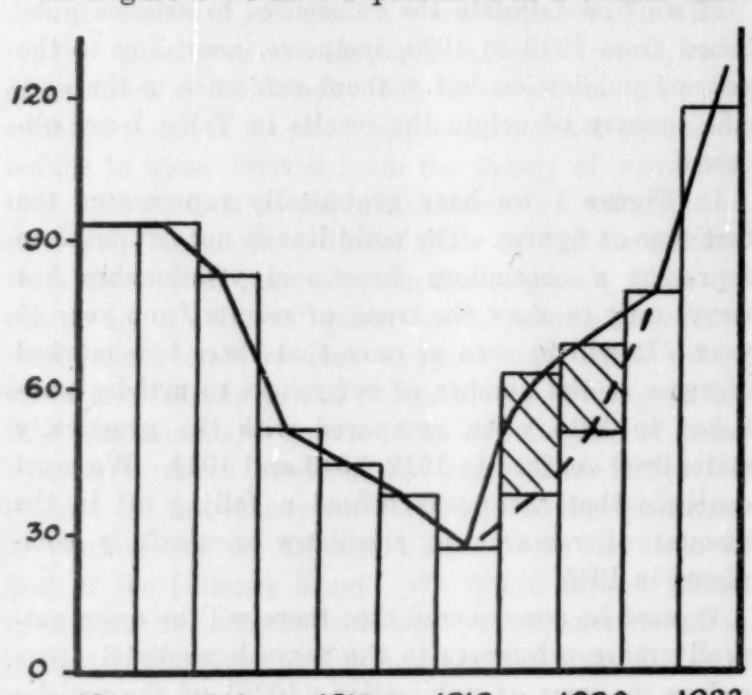


FIG. 2

It is obvious from consideration of Figure 2 that the course of research in the United States from 1914 to 1919 was different from its course in the rest of the world. We might investigate this still further by studying separately the trend in Germany, England and the United States. This can be done by considering the references to four or five typical journals in each of these countries.

In Table II we find the results of a tabulation of the references to five representative German journals. They were chosen to represent the fields of general, organic, inorganic, physical and biological chemistry. References to *Berichte der deutschen chemischen Gesellschaft* far outnumbered those to any other single periodical in 1926. There was a total of 686 references to this journal. In other words, over 18 per cent. of all references, excluding those to the *Journal of the American Chemical Society*, were to this single periodical. It is the more remarkable, therefore, that there was in 1926 not a single occasion for the investigators in America to refer to work published in the *Berichte* in 1918. It might be said that this is because the *Berichte* for 1918 was not available to American workers, but it should be remembered that although this might have been the case in 1919–20–21, it was not true after that. By 1923 the files of the *Berichte* in American scientific libraries had been brought up

TABLE II

Year	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Ber.	16	18	10	12	6	5	0	8	11	12	19	21
Ann.	11	3	13	2	3	1	1	1	2	3	2	5
Z. phys. Chem.	4	9	5	1	4	0	0	0	2	5	11	11
Z. anorg. Chem.	1	1	1	1	2	0	2	4	3	6	4	2
Biochem. Z.	2	2	4	1	0	2	0	0	0	1	2	4
German	34	33	34	17	15	8	3	13	18	27	38	43

Ber. *Berichte der deutschen chemischen Gesellschaft*, *Z. phys. Chem.* *Zeitschrift für physikalische Chemie*,
Ann. *Annalen der Chemie* (Liebig's), *Z. anorg. Chem.* *Zeitschrift für anorganische Chemie*,
Biochem. Z. *Biochemische Zeitschrift.*

to date, and therefore this journal was as available as any other when the work we are considering was being carried out.

The results of Table II are graphically portrayed in Figure 3. Here again the effect of the war is very

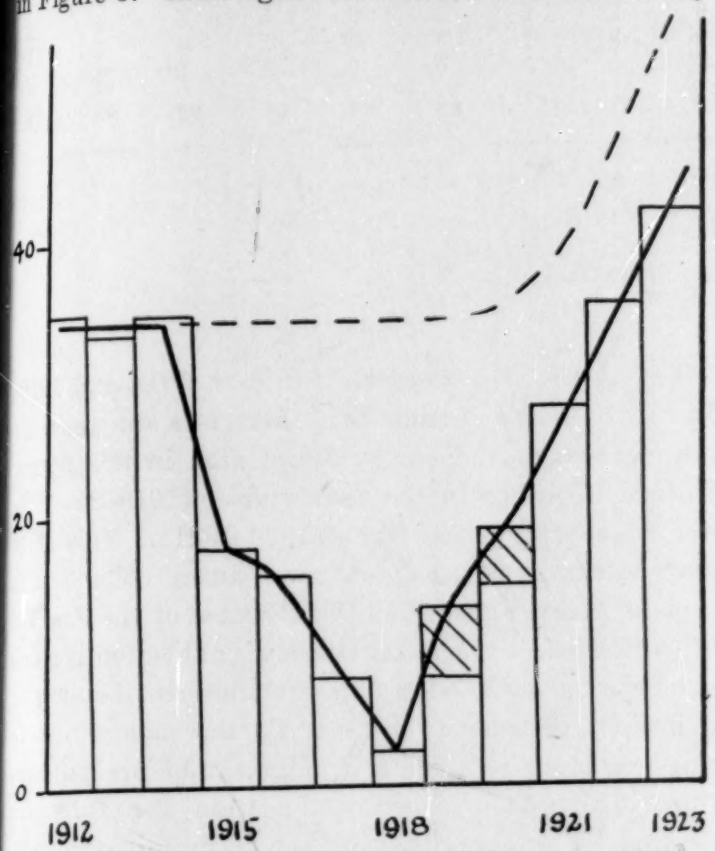


FIG. 3. References to five typical German periodicals.

marked and we must conclude that research in this most fundamental science was at a very low ebb in Germany in 1918; that Germany was hard pressed. The typical recovery curve noted in Figure 2 is also present here. Undoubtedly the areas cross-hatched in 1919 and 1920 represent work completed during the war but unpublished until later. Another point should be noticed here. It is that, apparently, recovery in Germany was not complete even in 1923, because, as we have mentioned earlier, we would expect much higher figures for 1922 and 1923 than for 1912 and 1913, because of the nearness of the former to 1926 researches. The broken line in the figure might well represent the normal curve excluding the effect of the war. The area between the broken line and the solid trend-curve is then a representation of the loss to fundamental science in Germany due to the war's effect.

Turning our attention next to British research we find the results shown in Table III.

It will be seen in Figure 4 that the effect of the war

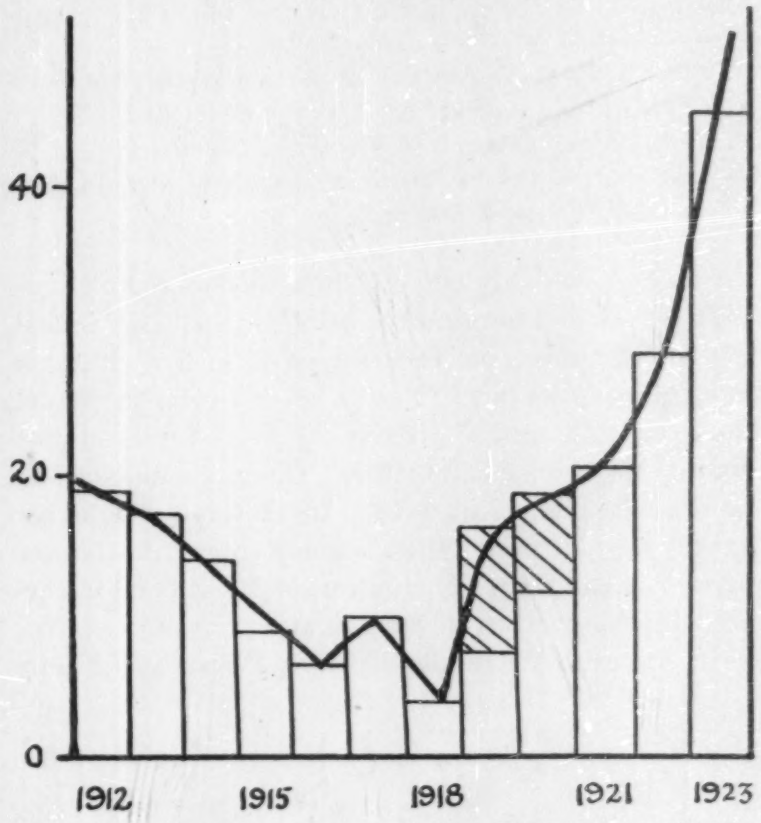


FIG. 4. References to four typical British periodicals.

on British chemistry was very similar to the effect noted in Germany, except perhaps that it was not so marked. The British loss was not so great because they did not have so much to lose. The typical convex recovery curve in the cross-hatched area should be noted.

The ultimate test of this method of measuring the war's effect on fundamental science should come when one considers a typical group of periodicals published in the United States. In 1914, there were in America basic industries, long dependent on Germany for certain essential chemicals; these industries found

TABLE III

Year	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
J. Chem. Soc.	15	13	14	8	5	5	4	10	12	13	17	28
Proc. Roy. Soc.	2	2	0	0	2	1	0	1	1	2	3	7
Phil. Mag.	2	2	0	0	0	4	0	5	5	4	2	2
Trans. Far. Soc.	0	0	0	1	0	0	0	0	0	1	6	8
British	19	17	14	9	7	10	4	16	18	20	28	45

J. Chem. Soc. *Journal of the Chemical Society* (London),
Proc. Roy. Soc. *Proceedings of the Royal Society,*
Phil. Mag. *Philosophical Magazine,*
Trans. Far. Soc. *Transactions of the Faraday Society.*

TABLE IV

Year	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
J. Am. Chem. Soc.	12	20	31	31	43	43	34	35	61	84	80	157
J. Phys Chem.	4	1	1	2	1	5	3	1	3	2	2	4
J. Biol. Chem.	0	1	4	6	2	2	3	2	7	5	4	13
J. Ind. Eng. Chem.	0	0	3	0	3	1	1	3	2	4	1	11
Phys. Rev.	0	1	0	0	2	3	0	0	3	2	1	2
American	16	23	39	39	51	54	41	41	76	97	88	187

J. Am. Chem. Soc. Journal of the American Chemical Society,
J. Phys. Chem. Journal of Physical Chemistry,
J. Biol. Chem. Journal of Biological Chemistry,
J. Ind. Eng. Chem. Journal of Industrial and Engineering Chemistry,
Phys. Rev. Physical Review.

themselves suddenly cut off from this source of supply. If we call to mind the need of the textile industry for dyestuffs, the seriousness of such a situation is at once apparent. It is to be expected, therefore, that the war should give scientific research in this country a decided impetus. There should be no marked falling off in 1915. In fact, we should not expect any decrease until after our entry into the war or even until 1918. Let us consider the facts uncovered by this method of investigation.

In Figure 5 the results of Table IV are graphically

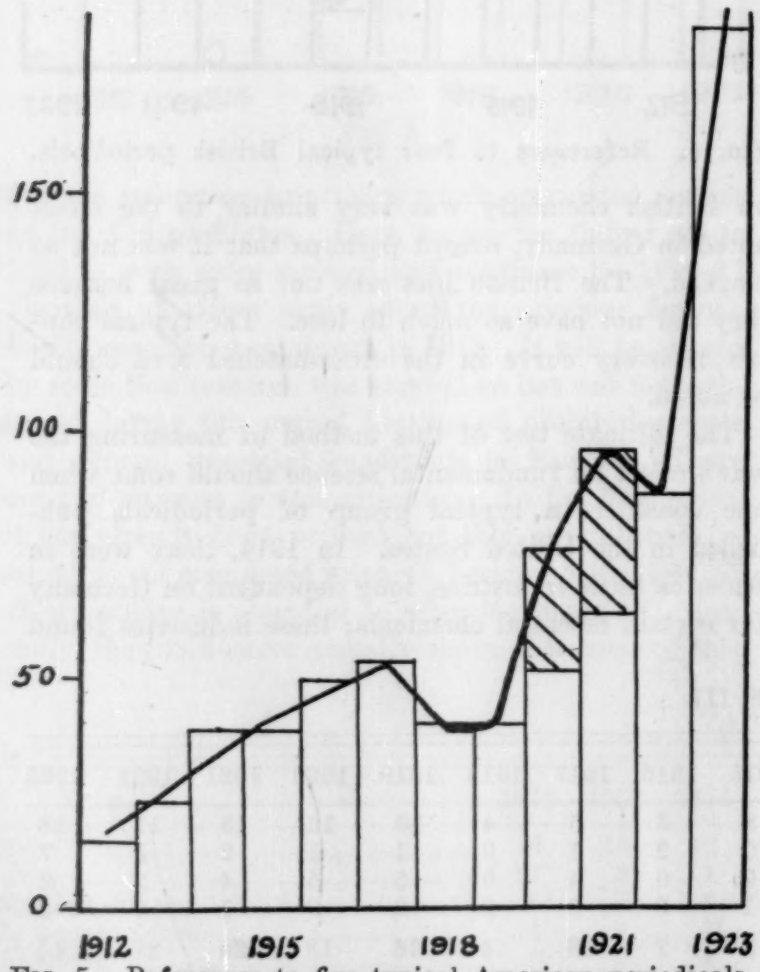


FIG. 5. References to five typical American periodicals.

shown. It will be seen at once that our predictions are correct. The trend-curve instead of dropping off as in the previous cases in 1915 continues to rise until 1917. A slight decrease is found in 1918 and 1919. It will be noted further that there is a difference in the location of the cross-hatched area in this figure. Instead of being in the usual place (1919–20) it is shifted a year to the right (1920–1921). This shift may be explained as due to two causes. The first is that in America, especially in the case of the *Journal of the American Chemical Society,* publication is much slower after submission of the manuscript because of the delay occasioned by sending the manuscript to three or more referees for judgment before publication. This often delays publication for fully six months. The second reason, not an unimportant one, is found in the fact that in America immediately after the war there was an unprecedented rush of the demobilized men to the graduate schools of science. This undoubtedly increased the ordinary curricular and academic duties of the research man in the universities and caused a further delay in the preparation of manuscripts, the work for which was completed during the war. In still other cases, the necessary permission of the War Department had to be obtained before work of this kind could be published. The maximum in 1921 may also be due in part to the work of graduate students who took part in this general return to schools immediately after the cessation of hostilities.

In conclusion we may summarize our findings as follows:

(1) War acts as a serious deterrent on research in combatant countries.

(2) War may give a distinct impetus to science in certain instances, especially in the case of research in countries which maintain neutrality. This is also magnified by the needs of a country (such as the United States in the last war) when it is suddenly cut off from supplies needed for basic industries, *e.g.,* dyestuffs for textiles, etc.

(3) Research in chemistry in Germany suffered far more than it did in England.

(4) The war, on the whole, had a distinctly beneficial effect on research in the fundamental science of chemistry in the United States.

P. L. K. GROSS

DEPARTMENT OF CHEMISTRY,
POMONA COLLEGE

SCIENTIFIC EVENTS

AWARD OF THE CONWAY EVANS PRIZE TO SIR CHARLES SHERRINGTON

IN February, 1925, the residuary trust funds of the estate of the late Dr. Conway Evans, medical officer for the Strand district, who died in 1892, were transferred to the president of the Royal Society and the president of the Royal College of Physicians of London and their successors in office that, in accordance with the terms of his bequest, they

> shall apply the same in giving rewards to such person or persons who, in the opinion of the presidents, have rendered or shall from time to time render some valuable contribution or addition to science as it exists at the time of my death either by invention, discovery or otherwise.

In accordance with this trust, the president of the Royal Society and the president of the Royal College of Physicians of London have made the first award of the Conway Evans prize, amounting to five hundred guineas, to Sir Charles Sherrington, on the ground that his work on the physiology of the nervous system, and chiefly on the physiology of the brain and spinal cord of the higher animals, has brought many complex nervous functions for the first time within the range of investigation and analysis. His discoveries have had a profound influence throughout the world on the experimental sciences of physiology and psychology and have thrown a flood of new light on many of the symptoms of nervous disease. In making his first award for some valuable contribution to science as it existed at the time of the death of the testator, the presidents of the Royal Society and of the Royal College of Physicians state that they have had no hesitation in selecting as conspicuously worthy of such recognition the work of Sir Charles Sherrington, which they believe to be of outstanding value for science and for humanity.

EXPLORATIONS IN THE REGION OF LAKES TITICACA AND POOPO

AN important journey in the region of Lakes Titicaca and Poopo, according to the *Geographical Journal,* was undertaken last year, with the support of various German bodies, by Dr. K. Troll, of Munich, who describes some of his results in *Petermanns Mitteilungen,* 1927, Nos. 1–2 and 7–8. The program laid down was very extensive, and included a study of the geology and morphology of the Bolivian Altiplano and its surrounding ranges, as well as of the vegetation and the agriculture, actual and potential. The La Paz valley was first examined and its relation to the glacial epoch made out. A careful study of the shores of Lake Titicaca and its ancient terraces was next made, and it was ascertained that the highest level (representing the Lake Ballivian of Bowman) was considerably older than the last ice-age. The next piece of work was the examination of the Cordillera and its eastern escarpment between Illampu and Apolobamba, where little had been known of the direction taken by the crest of the range and its relation to the hydrography. The conditions were found very similar to those of the La Paz system, the range being several times broken through by the Rio Mapiri, so that here too the water-parting is merely the sharply cut edge of the Altiplano. As in the case of the La Paz, the trenching was pre-glacial. Dr. Troll was able to join Professor A. Possnansky in a descent of the Desaguadero from Titicaca to Poopo in a motor boat, this being the first occasion on which the whole course of the river had been navigated. It led to the discovery that the river has since 1922 shifted its course considerably to the east before entering the lower lake. While traversing the Pampa north of Poopo (which is dry and not swamp as shown in the 1–M map of the American Geographical Society) the river flows at a slightly higher level than the surrounding plain, and its bank seems to have been breached at high water. Much attention was paid to the history of the lake basins in recent geological times, and some of the conclusions of Bowman as to the relations of the two ancient lakes ("Ballivian" and "Minchin") are considered to be incorrect. Both the modern lakes have shown a decided rise in level of late years. This had been known for some time as regards Titicaca, but Dr. Troll was able to establish the fact for Poopo also, where much vegetation on the banks has been killed by the flooding. It seems that the cause is a climatic one. Even though the journey was made at the end of the dry season, Poopo was found to be discharging by the Lacahuira River towards the "Salar" of Coipasa, although the lake has been held (as by Neveu-Lemaire of the French Commission of 1903) to have no outlet. (May not the discharge be a recent phenomenon, due to the rise in the level of the lake?) Dr. Troll ends by speaking of small remnants of primitive inhabitants that are still to be met with on the Altiplano, distinct from the Aimara and Quechua, and discusses recent projects for using the Desaguadero for navigation and irrigation. At the time of writing he was continuing his researches.

THE STOLL–McCRACKEN SIBERIAN–ARCTIC EXPEDITION

AN expedition, to be known as the Stoll-McCracken Siberian-Arctic Expedition of the American Museum of Natural History, is preparing to explore new lands on the Arctic coast of Siberia and collect flora and fauna for the museum.

The expedition will be financed and directed by Charles H. Stoll, a New York lawyer and sportsman, and led by Harold McCracken, associate editor of *Field and Stream,* who has spent five years in the Arctic and who is known as a photographer of wild animals. He spent two years at the head of an Ohio State University expedition in Alaska. Captain Robert A. Bartlett, commander of the *Roosevelt* when Admiral Peary reached the North Pole, will command the expedition's vessel, the *Morrissey,* which was used during the past two years by George Palmer Putnam on expeditions to Greenland and Baffin Land.

Other members of the expedition include Dr. H. E. Anthony, curator of mammals of the American Museum of Natural History; R. B. Potter, of the museum staff, and Edward Namley, of Marietta, Ohio, operator of the *Morrissey* radio.

The search for the natural mummies of the post-glacial period will be one of the objectives of the expedition. The party will explore Czar Nicholas II Land, an island of unknown size north of Cape Chelyuska off the coast of Asiatic Siberia, about 600 miles south of the Pole. It will study the economic possibilities of Kamchatka, which is rich in timber, coal, gold, lead, zinc and other minerals, and in grazing lands. But it will be concerned chiefly in hunting for the museum specimens of animals and birds of the north.

The expedition will sail north from Seattle about April 1. Captain Bartlett left on December 8 for Sydney, N. S., to bring the *Morrissey* to New York to be outfitted for the journey. He will then sail through the Panama Canal to Seattle to await the party.

The exploration will last about six or seven months. The *Morrissey* will sail from Seattle by the inside passage to Kodiak, Alaska, and thence to Unimak Island on the western end of the Alaska peninsula. The next stop will be Kamchatka, whence the journey will be up the Siberian coast and, when the weather permits, through the Behring Straits to the Arctic coast near the mouth of the Kolima River, where collections will be made.

THE NEW ALLEGHENY FOREST EXPERIMENT STATION

THE choice of Philadelphia as headquarters for the Allegheny Forest Experiment Station of the forest service, United States Department of Agriculture, has been announced by Secretary of Agriculture William M. Jardine. The headquarters of the station are being established in cooperation with the University of Pennsylvania, and offices will be furnished by the university, under an agreement signed by Provost J. H. Penniman, of the university, and Colonel W. B. Greeley, chief of the U. S. Forest Service. Secretary Jardine made the following statement:

> Selection of headquarters for the Allegheny Station marks the beginning of active work on the part of a new forest research unit of the Department of Agriculture. Although Philadelphia has been chosen as headquarters because of its central location and the stimulus to our work resulting from cooperation with a scientific institution of international repute, the field work of the station will be conducted at various centers in the States of Pennsylvania, Maryland, New Jersey and Delaware. In establishing such centers of field work, or branch stations, we have the advantage of cordial offers of cooperation from a number of organizations and educational institutions, prominent among them being the state agricultural colleges.
>
> The forest experiment station will be interested in nearly every phase of timber-growing, such as thinning and similar measures for stimulating growth, reforestation by natural methods as well as by planting, rate of growth of tree species, and protection of the forest against its many enemies. The station is fortunate in starting its work in a territory where the states have done exceptionally good work in forestry. The forest services of Pennsylvania, New Jersey and Maryland have been at work for years, and although the greater part of their effort has necessarily been devoted to fire protection, the management of state forests, and similar matters outside of the field of forest research, they have made substantial progress in this field as well.
>
> Some idea of the extent of the forest problems in this territory may be gained from a comparison of the lumber production and consumption of the four states concerned. A combined production of about 400,000,000 board feet is scarcely one eighth of the combined consumption. Yet there are in these four states over 18,000,000 acres of forest land which once bore as fine a forest of hardwoods, white pine, and hemlock as grew anywhere in the United States. The original forest has been practically all cut to meet the demands for wood of manufacturing, mining and agricultural industries. Forest replacement on hundreds of thousands of acres has been very inadequate, because of close cutting and fires. The scrub oak lands of Pennsylvania, and the ragged pine stands of southern New Jersey, to mention two outstanding examples only, are a challenge to the skill of the forester. Only painstaking study can give us the basis for the rehabilitation of such forests.

The staff of the experiment station will consist of seven persons at the start. Those appointed to date consist of R. D. Forbes, director, formerly director of the Southern Forest Experiment Station at New Or-

leans; O. M. Wood, of Pittsburgh, Pennsylvania; A. F. Hough, of Washington, D. C.; L. G. Schnur, of Erie, Pennsylvania, and Miss C. E. Skamser, of Colorado Springs, Colorado.

THE LONG ISLAND BIOLOGICAL ASSOCIATION

AT the annual meeting of the board of directors of the Long Island Biological Association, held on December 13, the following gifts were reported, applicable to the Biological Laboratory at Cold Spring Harbor, Long Island. About $15,000 have been received in contributions for research and current expenses during the year. In addition the treasurer announced a bequest of $5,000 from the late Dr. Walter B. James. Other special gifts, above the amount raised for current work, include $1,000 from Colonel T. S. Williams, $250 from Colonel Henry L. Stimson, $200 from Dr. C. B. Davenport, and $200 from Mr. Russell C. Leffingwell, all for the recently constructed physiological laboratory. Mr. Walter Jennings and Mr. William J. Matheson made special gifts of $750 each, and Mr. Mortimer L. Schiff, of $400 for equipment for mammalian research. The Wawepex Society contributed $500 additional toward the renovation of Hooper Hall. Mr. Arthur W. Page donated subscriptions to scientific journals, and the estate of Mary E. Jones gave the use of a building. The association has a number of building lots available for sale to biologists working at the laboratory. A form of sale, similar to the forms in use at other institutions, was accepted by the board. The treasurer reported that the end of the fiscal year found the association free from loans or other financial encumbrances. A budget of $44,870 was voted for 1928.

Announcement was made of a gift of $12,000 from Mr. and Mrs. Acosta Nichols, of Oyster Bay. This gift is applicable toward the construction of a new laboratory for biological research. It will be known as the George Lane Nichols memorial, in memory of George Lane Nichols who was for two years a member of the nature study classes for children given under the auspices of the Biological Laboratory. The new research laboratory will be located near the recently finished physiological laboratory. The architecture will be that of the Long Island colonial type, including a main building about 50 by 25 feet, two stories high, and two ells each about 15 by 20 feet. Each room will be equipped with running fresh water and sea-water, gas and electricity, while all of the rooms on the first floor will have work tables capping solid concrete columns for use in research in which vibration and jar should be reduced to a minimum.

With the completion of this building late in the spring, the floor space available for biological work at the laboratory will have been more than doubled in three years. This increase has been made necessary by the growing realization on the part of experimental biologists of the ease with which material for research may be procured at Cold Spring Harbor. This is particularly true of *Fundulus* and other marine forms. The addition of another operating room and another animal room in the new building will also allow an increase in mammalian research.

At the same time living accommodations are being increased through the renovation of a large house purchased last year, and the purchase, upon very favorable terms, of another house from Mrs. Alethea Stewart, widow of Mr. John H. J. Stewart, a member of the board of directors for many years.

SCIENTIFIC NOTES AND NEWS

THE American Association for the Advancement of Science meets this week in Nashville, under the presidency of Professor Arthur A. Noyes, of the California Institute of Technology. Preliminary announcement of the programs of the fifteen sections and the associated societies will be found in the issue of SCIENCE for December 2. Dr. L. H. Bailey, retiring president of the association, is recovering from a surgical operation and is unable to be present at the Nashville meeting. He has not found it possible to prepare an address.

DR. SAMUEL WILSON PARR, professor emeritus of industrial chemistry in the University of Illinois, has been elected president of the American Chemical Society for 1928, succeeding Dr. George D. Rosengarten, of Philadelphia.

RUDOLPH F. SCHUCHARDT, electrical engineer at the Commonwealth Edison Company, Chicago, has been nominated for president of the American Institute of Electrical Engineers for the term beginning August 1, 1928.

THE Langley medal for aerodromics was presented to Colonel Charles Lindbergh at the annual meeting of the board of regents of the Smithsonian Institution on December 8. At the same time Colonel Lindbergh announced that the backers of the *Spirit of St. Louis* had met recently in St. Louis and had decided that the plane should ultimately be given to the Smithsonian Institution.

DR. WILLIAM J. MAYO, Rochester, Minnesota, was made commander of the Royal Order of the North Star by King Gustav of Sweden on November 28.

PROFESSORS NIELS BOHR and Albert Einstein have been elected foreign honorary fellows of the Royal Society of Edinburgh.

THE degree of doctor *honoris causa* of the University of Paris has been conferred on Sir Frederic Kenyon, director of the British Museum, and Professor J. S. E. Townsend, Wykeham professor of physics in the University of Oxford.

THE honorary degree of D.Sc. was conferred by the University of Oxford on Edward Ball Knobel, for ten years secretary and twice president of the Royal Astronomical Society.

THE Buckston Browne prize, which includes a medal and £100, of the Harveian Society of London for the best essay on "The Pathology, Diagnosis and Treatment of New Growths originating in the Walls of the Urinary Bladder," has been awarded to Lionel R. Fifield.

THE Langley memorial prize, which was founded by a friend of the late Dr. W. H. Langley, principal medical officer of Southern Nigeria, has been awarded to Dr. A. S. Burgess, of Accra, Gold Coast, West Africa, for his paper, "The Selection of a Strain of *Bacillus pestis* for the Preparation of Vaccine, with Special Reference to the Effect of Animal Passage on Virulence."

AT the annual general meeting of the fellows of the National Institute of Agricultural Botany at Cambridge, England, Sir Daniel Hall, chairman of the council, presented the John Snell memorial medal for 1926 to Sir Matthew Wallace.

THE following officers of the Cambridge Philosophical Society have been elected for the session 1927–28: *President,* Dr. H. Lamb; *vice-presidents,* Professor J. T. Wilson, Professor A. Hutchinson, Professor G. I. Taylor; *treasurer,* F. A. Potts; *secretaries,* F. P. White, R. H. Fowler and F. T. Brooks.

PROFESSOR GOSSET, of Paris, has been elected president, and Professor Tixier, of Lyons, vice-president, of the French Congress of Surgery to be held during the coming year.

THE seventieth birthday of Professor S. G. Navaschine, the distinguished Russian botanist, was celebrated in Moscow on December 21 at a special meeting held in the university, when congratulatory addresses and greetings were presented to him.

Nature notes that on December 7 Professor Louis Dollo, honorary conservator at the Royal Museum of Natural History at Brussels, attained the age of seventy years. On that day there was presented to him a commemorative volume containing articles by fifty-five biologists, as an appreciation of his work in extending to fossils the laws that govern all forms of life.

DR. R. T. A. INNES is retiring at the end of this year from the post of director of the Union Observatory, Johannesburg.

PROFESSOR E. C. WILLIAMS has resigned from the Ramsay chair of chemical engineering, tenable at University College, London, to take effect at the end of the second term of the session 1927–28.

DR. E. H. FARRINGTON, for thirty-three years head of the dairy department at the University of Wisconsin, has been appointed emeritus professor of dairy husbandry.

GEORGE A. OLSON, agricultural director of the Gypsum Industries, Chicago, has resigned, his resignation taking effect on February 1.

DEAN GERALD WENDT, of the school of chemistry and physics of the Pennsylvania State College, has resigned, effective July, 1928, to become director of the newly founded Battelle Memorial Institute for scientific and industrial research at Columbus, Ohio. Plans for the first two buildings of the new institute, costing about $500,000, are now being completed and construction will begin early in the spring.

DR. JOHN S. BOYCE, pathologist in charge of the Portland, Oregon, headquarters of the forest pathology work of the U. S. Bureau of Plant Industry, has been appointed director of the Northeastern Forest Experiment Station at Amherst, Mass. This appointment will be effective early in 1928, the station in the interim being in charge of M. Westveld, associate silviculturist, as acting director.

HAROLD A. THOMAS, professor of hydraulics in the department of civil engineering at the Carnegie Institute of Technology, has been appointed hydraulic engineer for the city of Pittsburgh to make a study of flood heights as affected by various proposed changes on the water fronts.

J. N. TAYLOR, of Smyrna, Delaware, has been appointed to the chemical division of the Bureau of Foreign and Domestic Commerce, to be in charge of drugs and fine chemicals.

JOHN A. STEVENSON, botanist in the office of foreign plant introduction of the U. S. Bureau of Plant Industry, has been transferred to the office of mycology and disease survey of the same bureau. He will have charge of the mycological collections, taking the place made vacant by the resignation of Dr. James R. Weir, who is now working on rubber-disease problems in British Malaya.

DR. ERNEST J. WILHELM has been appointed to the newly established research fellowship in the depart-

ment of chemistry in the University of Notre Dame, for which funds have been provided by the Grasselli Chemical Co.

DR. JACOB MARKOWITZ, Toronto, has gone to the Mayo Foundation as first assistant in the division of experimental surgery and pathology.

DR. HOWARD A. KELLY, professor emeritus of gynecology, Johns Hopkins University School of Medicine, Baltimore, will deliver the Hunterian oration before the Hunterian Society in London, on January 16. The occasion is the two hundredth anniversary of the birth of John Hunter. The last Hunterian address was delivered by Dr. John M. T. Finney, of Baltimore.

DR. LOUIS B. WILSON, director of the Mayo Foundation for Medical Education and Research, will be the founder's day speaker of the ninetieth session of the Medical College of Virginia, January 20. At the same time the cornerstone will be laid for Cabaniss Hall, the new women's dormitory.

THE third annual Scripps Metabolic Clinic lecture for the San Diego County Medical Society will be given on January 7, at La Jolla, San Diego, by Dr. Cyrus C. Sturgis, director of the Thomas Henry Simpson Memorial Institute for Medical Research, Ann Arbor, on "Pernicious Anemia."

DR. SAMUEL L. HOYT, of the research laboratory of the General Electric Company, will give the second of the annual Priestley lectures in chemistry at the Pennsylvania State College from January 16 to 20. Dr. Hoyt will talk on "The Physical Chemistry of Metals and Alloys."

DR. OSKAR KLOTZ, professor of pathology and bacteriology, University of Toronto faculty of medicine, gave one of the DeLamar lectures in hygiene at the Johns Hopkins University School of Hygiene and Public Health on December 6 on "Yellow Fever in West Africa."

DR. EDWARD STARR JUDD, of Rochester, Minn., recently gave the Mutter lecture of the College of Physicians of Philadelphia on "Gastric and Duodenal Ulcer."

THE Christmas week lectures for young people on the James Mapes Dodge Lecture Foundation of the Franklin Institute were given on December 27, 28 and 29 by Dr. Wilder D. Bancroft, professor of chemistry in Cornell University. The titles of Dr. Wilder's lectures were "Combustion," "Comfort" and "Color."

WILLIAM BEEBE, of the New York Zoological Society, has returned from a lecture tour extending from St. Paul to New Orleans on which he spoke over fifty times on the subject "Beneath Tropic Seas," dealing with his work on the life of coral reefs on his recent tenth expedition of the department of tropical research of the New York Zoological Society.

PROFESSOR HAROLD D. FISH, director of the Karatabo Laboratory of Tropical Biology, British Guiana, will lecture before the Geographic Society of Chicago on January 10 on "Jungle Explorations in British Guiana."

ON December 10, Professor Alan W. C. Menzies, professor of chemistry at Princeton University, delivered an address to the Royal Canadian Institute, Toronto, on the subject "Atoms and how they combine."

DR. WM. M. DAVIS, professor emeritus of geology at Harvard University, will again visit the University of Arizona during the second semester this year as lecturer in physiography.

ON December 3, Dr. Chas. N. Gould, director of the Oklahoma Geological Survey, delivered a lecture before the Kansas Geological Society at Wichita, Kansas, on the subject "The Permian Problem in Kansas and Oklahoma."

THE Technical College in Vienna recently commemorated the centenary of the invention of the propeller, which is ascribed to Joseph Ressel, an Austrian forester.

DR. R. A. HERMAN, lecturer in mathematics in the University of Cambridge, died on November 29, aged sixty-six years.

DR. M. BAMBERGER, emeritus professor of inorganic chemistry at the Technische Hochschule in Vienna, died on October 22, aged sixty-six years.

PROFESSOR PAUL VON GROTH, for many years professor of mineralogy in the University of Munich, died on December 2, in his eighty-fifth year.

ACCORDING to a cable to the New York *Times*, Professor Vladimir Michaelovich Bakhterev, the distinguished Russian psychologist, died on December 24, at the age of sixty-nine years.

PROFESSOR DR. K. D. GLINKA, of Leningrad, Russia, who was elected president of the International Society of Soil Science during the world soil congress in Washington last June, died on November 2. He was known especially for his work in the field of soil classification.

PROFESSOR KEIZO NIWA, professor in the Tokyo Imperial University, an authority on Japanese pharmacology, died on October 19.

THE Philadelphia County Medical Society conducted a symposium on "The Oral Administration of Synthalin and Neosynthalin in the Treatment of Diabetes," at a special meeting on December 21. Dr.

E. Frank, professor of medicine at Breslau, Germany, discussed "Chemical Experimental and Clinical Investigation of Synthalin and Neosynthalin," and Drs. Orlando H. Petty, Carl Schumann and Horace B. Conway and W. S. Carr, "The Clinical Investigation of Synthalin and Neosynthalin."

THE spring meeting of the American Electrochemical Society, which will take place at Bridgeport, Conn., in April, will be featured by a symposium on "The Chemical Production of Electricity" under the chairmanship of Dr. G. W. Vinal, of the U. S. Bureau of Standards. Among those who will take part in the symposium are Marion Eppley, president of Marion Eppley, Inc.; Geo. E. Stringfellow, vice-president, Edison Storage Battery Co.; M. L. Martus, president, Waterbury Battery Co.; and C. A. Gillingham, Works Mgr., National Carbon Co. The discussion will include standard cells, dry cells, gas cells, storage batteries, electrolytic rectifiers, etc. This session will be held on April 26.

THE Budapest correspondent of the *Journal* of the American Medical Association reports that on the suggestion of the secretary of the congress for cellular research held recently in Budapest, the management resolved to appoint one European committee and one extra-European committee. Members of the European committee are Rhoda Erdmann, of Berlin; A. Fischer, of Dahlem, Germany; G. Levi, of Turin, and Fauret-Premiet, of Paris. The extra-European committee consists of R. G. Harrison, of New Haven, A. Carrel, of New York, and W. H. Lewis, of Baltimore. The cooperation of the two committees is maintained by Rhoda Erdmann, as the permanent general manager of the Society of Cytologists, whose periodical, the *Archiv für experimentelle Zellforschung*, becomes the official organ of the society. Within one year the delegates of the separate nations will organize those interested in cellular research in their own countries, and each of these national societies will delegate one member to the proper committee. Decision as to the time and place of the next congress must be made on the basis of the written votes of all the delegates. It was unanimously accepted that the name of the society be altered for a more general one in order to render possible the participation of members of other scientific societies. The name of the society will be International Experimental Cellular Research Society.

THE shipment from China of scientific specimens obtained by archeological and other scientific research expeditions has recently been strictly limited as a result apparently of an increasing nationalistic spirit. Research has thereby been greatly hampered.

GIFTS by Edward Epstean, of New York, of 200 volumes to the chemical library at Columbia University and of the death mask, a cast of the hands, the photographic apparatus and two likenesses of the late Karl Klietsch, of Vienna, to the Chandler Chemical Museum, have been announced. Klietsch was the inventor of the photogravure and rotogravure processes, and his camera, plate-holders and his tools are of great interest.

THE Hooper Foundation for Medical Research has set aside an annual allotment of $5,000 to carry on research in infantile paralysis. Following an appeal to the public, the director of the foundation has received more than $7,000 in donations to be used in providing serum for children who may contract the disease.

DR. R. B. WILD, who has recently retired from the Leech chair of materia medica and therapeutics at the University of Manchester, has made a gift of £250 for the endowment of a prize in pharmacology.

THE late Sir Arthur Shipley, of the University of Cambridge, bequeathed to the Molteno Institute his books connected with parasitology; to the Balfour Library his books connected with zoology, and to the Library of the Philosophical Society certain of his scientific books.

As has already been recorded in SCIENCE, Eldridge R. Johnson, formerly president of the Victor Talking Machine Company, has given $800,000 to the University of Pennsylvania to establish the Eldridge R. Johnson Foundation for Research in Medical Physics. It will have as one of its purposes the scientific determination of the value which may attach to a variety of physical methods used in the study and especially the treatment of disease. Some idea of the range of studies that will be carried on in the new foundation may be gained from the fact that the plans call for six laboratories, each having a definite field of activity. They will be: (1) A laboratory for studies in light and optics, including investigations relating to sunlight, mercury-quartz lamp rays and infra-red rays. Radium emanations, roentgen rays and highly related topics in this field also will fall under this division. (2) A laboratory for studies of the effects of heat, including the biologic aspects and the practical bearing of heat on problems of disease and its treatment. (3) A laboratory for studies in sound and audition, including the investigation of hearing and the application of instrumental methods for improving human hearing. This laboratory also will conduct studies in the reproduction of sounds (heart-sounds and the like), and in the physical effects of sound. (4) A laboratory for the determination of physical measurements—for studies of movements in

the human body such as heart action, movements of the stomach and intestines, the flow of blood and the intake and output of air. (5) A laboratory for photographic and cinematographic study of bodily processes and conditions. (6) A laboratory for the study of electricity in its relation to the diagnosis and treatment of disease.

DR. BARTON WARREN EVERMANN, director of the museum of the California Academy of Sciences, has, with the authority of the council, sent two men from the museum staff to the Galapagos Islands to do scientific work. The men sent are Mr. Joseph R. Slevin, curator of herpetology, and Mr. Frank Tose, chief of exhibits. They sailed from San Francisco as the guests of Captain G. Allan Hancock on his private yacht, the *Ococa,* on November 23. They planned to finally reach the Galapagos Islands about the first of December, where they expected to remain some time. The purpose of the expedition so far as the academy is concerned is to do general collecting for the museum and to obtain accessory materials for a number of habitat groups, including at least one species of gigantic tortoise and one or two of the giant iguanas. Captain Hancock is interested in scientific problems and especially in photography. He has taken with him as his official photographer Mr. George E. Stone, an expert in moving pictures and still photography. The expedition will return to San Francisco about the middle of January.

THE proposed standard on symbols for hydraulics has been prepared by subcommittee No. 2, of which G. E. Russell, professor of theoretical hydraulics of the Massachusetts Institute of Technology, is chairman. This subcommittee was organized on May 3, 1926, by direction of the executive committee of the sectional committee on scientific and engineering symbols and abbreviations of the American Society of Mechanical Engineers for the purpose of recommending a list of standard symbols for use in the field of hydraulics. The proposed tentative standard has received the approval of the subcommittee and is now being circulated with a request for criticism and comment. Communications should be addressed to Preston S. Millar, secretary of the sectional committee.

Museum News states that a request for a city appropriation of $10,000 for 1928 has been made by the San Diego Society of Natural History, which bases its plea on the fact that its museum is open to the public daily, without charge, and that it maintains a school service, lecture program, nature walks and excursions and carries on explorations and research work. City funds are granted to three similar institutions in the city.

AN out-door botanical and biological laboratory and demonstration ground will be developed at the University of Wisconsin, if plans originated by Regent M. B. Olbrich, of the state university, and approved by the board of regents at its December meeting carry through. The regents appropriated an $83,000 balance in the Tripp Estate fund to aid in the purchase of land adjoining Lake Wingra, with the understanding that at least as much more will be provided from other sources. The Olbrich plan provides for the purchase of from 700 to 1,000 acres with a frontage of 8,000 feet on Lake Wingra—the whole of what is known as the Lake Forest area at Madison. The tract would be set aside as a forest preserve, arboretum and wild life refuge.

GIFT to the State of Massachusetts of twenty-six acres in Boxford, to be used as an addition to the Crooked Pond Wild Life Sanctuary, has been announced by William A. L. Bazeley, state commissioner of conservation. The givers are the Associated Committees for Wild Life Conservation, representing the Massachusetts Audubon Society, the Massachusetts Fish and Game Protective Association and the Federation of Bird Clubs of New England, Inc.

THE college of agriculture of the University of Wisconsin has been authorized by the university regents to engage in a cooperative program of forest conservation research with the state conservation commission and the U. S. Forest Service. The problem which will first be studied under the authorization of the regents is treatment of farm wood lots and swamp tracts. Problems relating to commercial forest tracts also are included in the general program.

UNIVERSITY AND EDUCATIONAL NOTES

THE Yale University endowment fund drive has passed its goal of $20,000,000.

AT George Washington University the college of engineering, which was formerly under the department of arts and sciences, has been replaced by a separate school of engineering in the recent reorganization of the university.

DR. M. ALLEN STARR has given $2,500 to constitute the Starr Fund for the department of neurology in Columbia University, either the principal or income of which may be used at the discretion of the executive head of the department.

DR. GUSTAV BOHSTEDT, chief of the animal husbandry department of the Ohio Agricultural Experi-

ment Station, has been called to the University of Wisconsin to head the research investigations in animal husbandry, a position made vacant by the resignation of F. B. Morrison, assistant dean of the College of Agriculture, who recently accepted the directorship of the New York Agricultural Experiment Stations.

AT the University of California, E. O. Essig, associate professor of entomology and associate entomologist, has been appointed professor of entomology and entomologist at the experiment station. Dr. Edwin C. Van Dyke, associate professor of entomology, has been appointed professor of entomology.

DR. WALTER BARTKE has been appointed assistant professor in mathematical astronomy at the University of Chicago.

DR. F. R. DAVISON, who for the past two years has been head of the bacteriology and biochemical departments of the Wm. S. Merrell Company, has resigned to accept the position of assistant professor in biochemistry at Rutgers University.

DR. ISADORE D. BRONFIN, medical director of the national Jewish Hospital, Denver, has been appointed assistant professor of medicine at the University of Colorado School of Medicine, Denver.

P. C. RAIMENT, demonstrator in biochemistry at the University of Oxford, has been appointed to the chair of physiology in the State University of Egypt, at Cairo.

DR. STANISLAS LORIA, professor of theoretical physics at the University of Lwów, Poland, has been appointed professor of experimental physics and director of the physical laboratory at the university. Professor Loria spent two years, 1923 and 1925, in America working and lecturing as research associate at the California Institute of Technology.

DISCUSSION AND CORRESPONDENCE

WEIGHT AND TEMPERATURE

THERE is a recurrent myth to the effect that mass varies with temperature, hoary with age, familiar to most physicists and chemists. It has been investigated many times and reported as due to convection currents of heated air acting either on the hot object weighed or on the balance pan.

The apparent loss in weight of a heated object is perfectly definite and repeatable and is of the order of 50 milligrams for a platinum crucible or pyrex beaker having a surface of 100 square cm. when heated to 600 degrees. The balance pan is protected from rapid heating by a ring or gauze of highly oxidized metal and the heated object left on it but a few seconds, just long enough to get the direction of the first swing. The temperature curve so obtained is a smooth hyperbola. The effects of convection and of expansion of the balance arm are relatively sluggish in coming into play and are readily recognized and avoided by any one familiar with precise weighing.

The apparent loss in weight is roughly proportional to surface and not to mass. This was shown by comparing the effect on a thin platinum crucible with that on a platinum button. The curves of loss in weight per unit area, plotted against temperature, were nearly coincident for glass, platinum and sheet gold but lower for aluminum, copper and iron (polished wire, coiled). The change with temperature is large at the lower temperatures, becoming less and less until at 900° it is too small to measure.

Since hygroscopic materials change in weight on heating in the manner just described, the effect was at first attributed to loss of adsorbed water. A lump of gold was weighed, then rolled into sheet, weighed, then melted into a lump, alternately, six times, each time heated to 600° to remove grease but weighed cold. A film of moisture would cause the sheet to weigh more than the button. A consistent difference of 1.2 mg. was found, probably due to adsorbed moisture, whereas the loss of weight on heating was of the order of 40 mg. Hence that loss could not be due to driving off adsorbed water.

Next a platinum crucible and the sheet gold were suspended in a furnace and thus weighed at various temperatures. The only change in weight found was a slight gain (2 mg.) such as would be caused by the decreased density and buoyancy of the heated air within the furnace. This disposed of the hypothesis of adsorbed moisture driven off by heat.

Finally, a crucial experiment indicated the actual cause of the apparent change in weight. The effect was first carefully determined on a platinum crucible. Repeating with the crucible *inverted* showed precisely the same loss in weight. Then a second crucible, slightly larger than that heated, was used as a cover for the heated inverted crucible, completely enclosing it down to the balance pan and eliminating convection currents entirely. In this case also the loss in weight was the same as before. The three losses check to within less than 2 per cent.

Warm air in contact with a heated surface must be at the same pressure as the surrounding atmosphere but less dense and more viscous. If it be lightly held in position (weakly adsorbed) by the solid, it will in effect increase the volume of the solid and therefore enhance the buoyancy of the surrounding air. To produce the losses in weight observed, layers of fixed air 0.5 to 3 mm. deep would be required. This explanation is not entirely acceptable

but is apparently the only one in harmony with observed facts.

P. G. NUTTING

GEOLOGICAL SURVEY,
WASHINGTON, D. C.

INFLUENCE OF POLARIZED LIGHT ON PHOTOCHEMICAL REACTIONS

I HAVE read with keen interest and great delight the article by Dr. S. S. Bhatnagar appearing in SCIENCE for October 14, entitled the "Selective Effects of Polarized Radiations on certain Photochemical Reactions." In this article the author announced his findings concerning the remarkable acceleration of chemical reaction between the amalgams of the alkali metals and water produced by exposure to polarized radiations. In the interest of historical accuracy and scientific priority I beg to submit for publication the following information which may not be known to scientists at large. Our esteemed Hindu colleague states in his paper that "As far as the author knows, this is the first purely chemical reaction as distinguished from the biochemical reactions studied by previous investigators which has definitely been shown to be selectively affected by polarized radiations." It is evident that owing to the slow communication between the United States and India he was not aware of the fact that on April 12, 1927, I and Dr. W. T. Anderson, Jr., read a paper before the American Chemical Society at the Richmond meeting entitled "The Effect of Polarized Light on the Pharmacological Properties of Some Drugs." In that paper which was published in the *Journal* of the American Chemical Society for August 5, 1927, and which was broadcast by "Science News," we have described our findings concerning the effects of polarized light on the pharmacological and chemical reactions of certain drugs. The profound changes produced by polarized radiations on the substances studied were certainly due to photochemical changes produced in their chemical structure because the chemicals were first irradiated and only subsequently tested. This was demonstrated not only by pharmacological means but also in the case of cocain by purely physical chemical tests, namely, changes in hydrogen-ion concentration, and in the case of quinin tartrate by the changes produced in its optical rotation. It is hardly necessary to state that the drawing of distinctions between biochemical and other chemical reactions is mere academic quibbling. I wish to call attention furthermore to the fact that a preliminary paper concerning the effects of polarized light on the reactions of certain drugs was published by me and John C. Krantz, Jr., in the *Journal* of the American Pharmaceutical Association for March, 1927.

In the present communication I wish to announce briefly the results of certain other experiments performed by me which I mentioned at the above meeting of the Chemical Society, but which were reserved for publication in a later paper. I have studied the effects of polarized light on five groups of optically active alkaloids. These were the following: Cocain, Epinephrin, Hyoscyamin, Scopolamine (Hyoscin) and Physostygmin. Solutions of each of these alkaloids after irradiation with polarized light were found to have undergone photochemical changes as evidenced by numerous pharmacological tests. An examination of various stereo-isomers in this connection revealed the remarkable fact *that the laevo variety in every case was the one most profoundly affected by polarized light.* These experiments have been in progress for a long time and would have been published at an earlier date had it not been for the unusually unsympathetic attitude towards our investigations on the part of certain American scientists, which fortunately did not discourage us in our work but which did compel us to repeat unnecessarily a large number of experiments otherwise quite clear cut, flawless and fool-proof. It is but fair to add in this place that the whole investigation could not have been conveniently carried out had it not been for the encouragement and facilities extended to us by two private industrial laboratories, namely, the Pharmacological Research Laboratory, Hynson, Westcott and Dunning, of Baltimore, and the Physico-chemical Research Laboratory of the Hanovia Company, Newark.

DAVID I. MACHT

PHARMACOLOGICAL RESEARCH LABORATORY,
HYNSON, WESTCOTT AND DUNNING,
BALTIMORE, MARYLAND

FLOOD EROSION AT CAVENDISH, VERMONT

ONE of the tragic but geologically most interesting happenings connected with the recent Vermont flood occurred at Cavendish village, which is located on the east slope of the Green Mountains some fourteen miles from Summit Station on the Rutland Railroad.

Here, during the early morning of November 4, after some twenty-four hours of heavy rain, part of a highway leading from the village down the valley was suddenly engulfed, carrying with it seven houses, numerous barns, garages and their contents. Happily no lives were lost, but the unfortunate people, with almost no warning, witnessed the total destruction of their property and even of the land upon which it stood. The loss is estimated at from $35,000 to $40,000.

The draining away of the waters revealed, where once the road had been, a yawning gully some forty feet deep, two hundred feet wide at the bottom and

probably a quarter of a mile long. The gully opened a new course to the river and, a mile below at the village of Whitesville, the remains of the structures were found, so utterly demolished as to be unrecognizable even to their former owners.

Many places have been damaged in the past and some destroyed because a dam failed; here was one which suffered because the dam held.

The village of Cavendish is situated on the north margin of the flood-plain of the Black River, which rises in the mountains and flows in a generally southeasterly course to its confluence with the Connecticut. The valley is perhaps half a mile wide at the village. Just east a large hill rises dividing the valley into two branches. The river flows through the south branch, where it has been dammed; while the highway in question ran through the north branch to Amsden, Ascutneyville and the Connecticut River. A dike in the valley, west of the hill, protected Cavendish from the impounded river water, while a storm-sewer laid under the highway drained the surface water down past the hill, where it could join the river. When the flood came the dam held fast but the dike broke and the sewer sections probably became loosened and carried away, thus enabling the flood waters to erode both above and below the highway with the disastrous results noted.

The great gully, eroded down to an easterly-sloping, gneissic bedrock, reveals the pre-glacial channel of the river, showing striations, chatter marks and pool-basins at the foot of the old rapids. The retreat of the ice-sheet filled the valley with till and impounded a lake whose terraces are in evidence for several miles up the valley. Later the river found a new outlet, this time to the south of the hill mentioned, and its old hidden course became a highway.

And so, unwittingly, the villagers built their houses "upon the sand" and the floods have borne out the truth of the old parable as they probably have been doing ever since it was uttered.

E. C. JACOBS
UNIVERSITY OF VERMONT

ILLUSTRATIONS WHICH DO NOT ILLUMINATE THE PROBLEM

IN a recent issue of SCIENCE (November 4, 1927), Dr. R. G. Aitken, associate director of the Lick Observatory, contributes an article entitled "Old Problems with new Illustrations" in which certain statements of recent astronomical observations have been somewhat peremptorily challenged. The name of none of the offenders is mentioned, yet, in one case, the quotations used coincide verbatim with sentences in a recent article of mine, "Island Universes" (*Natural History*, Vol. 26, 286, 1926, and Harvard College Observatory Reprint No. 32). Dr. Aitken furnishes additional identification marks showing that the quotations are from my article. In view of this I feel justified in trespassing upon the columns of SCIENCE in order to present the facts of the case.

Four points are specifically brought up by Dr. Aitken.

1. The total number of stars in the Galactic system is put down in my article as "about fifty billion," whereas Dr. Aitken says that, "according to the most careful and reliable investigation so far made" this total number is very hesitatingly put at thirty billion. There is good evidence that the fraction of all the stars in space which are visible even with the greatest telescopes is probably in the neighborhood of one or two per cent. The estimated total therefore involves great extrapolation. In describing the results in a popular article, where, as is evident, the argument requires an upper limit for this total number of stars, the use of fifty billion instead of thirty billion is not only justified by its practical equivalence, but it is almost necessary.

2. An objection is made against my statement that a star may be a thousand times as large as the sun in diameter. The facts are, as Dr. Aitken says, that the largest measured diameter is certainly not more than half, and possibly not more than one third of this value.

In 1906 Hertzsprung published a formula for predicting the angular diameter of a star when the color and the apparent magnitude are known. When in 1920 the first stellar diameters were measured, they proved to agree within thirty per cent., which, I am sure, astronomers generally regard as an excellent agreement in the case of such pioneer work. We may then perhaps be allowed to consider the formula used by Hertzsprung as well established, and use it, to extend our values to other stars which had hitherto fallen outside the region of calculations. In Harvard Reprint 25 and Harvard Circular 271, 1925, Shapley cites the existence of some very red stars in the Magellanic Clouds which, on the basis of the formula predicting stellar diameters would have linear diameters of the order of magnitude of 10^9 kilometers, the sun's diameter being 1.4×10^6 kilometers. Here I should say that I can not satisfy the reader who looks for an exact statement to the nearest million miles; round numbers, which imply large uncertainties, are more to my liking.

3. I am accused of having remarked "blithely" that "fifty billion years is but a short interval in the life of an average star." I should indeed be most grateful to Dr. Aitken if he could produce any valid arguments to the contrary. Recent papers on stellar ages mention figures of the order of 10^{13} to 10^{15} years,

compared with which 5×10^{10} is indeed a short interval.

4. I wrote: "Observations with the spectroscope made *principally* at the Lowell and Mt. Wilson Observatories have shown us that the Andromeda Nebula is approaching us with a speed of 200 miles a second, the Magellanic Clouds are receding from us at the rate of 176 miles per second." It seems inconceivable that any one would be able to read into this sentence the meaning that "the Magellanic Clouds *have recently moved so far north* (italics mine) that their radial velocities can be and have been measured from Mt. Wilson and Flagstaff." The radial velocities of these objects were actually observed at the Chilean station of the Lick Observatory, which might well have been mentioned.

Summing up, I should say that I entirely agree with Dr. Aitken that the writer of a popular article owes it to his readers not to make overbold statements. However, one must consider that in writing a popular article, one can not stop to explain all side issues, by footnote or reference, in the same way as is done in scientific articles; such points are essentially matters of personal judgment.

WILLEM J. LUYTEN
HARVARD COLLEGE OBSERVATORY

ORIGIN OF THE PRAIRIE

PROFESSOR PHILIP M. JONES in SCIENCE for October 7 (Vol. LXVI, No. 1710) suggests as a theory for the origin of prairies in the Middle West "rapid drainage at the close of the ice age."

It is doubtful if this theory, or any other relying upon a single factor, can explain very extensive grassland areas, either in the Middle West or elsewhere.

Treeless areas tend to develop in arid or semiarid regions, or where, even though there may be abundant rainfall, the water table is low by reason of unusually free subsurface drainage. In the latter instance, if indeed not in the former, the presence of a large number of grazing and browsing animals is an important factor. Starting on such "negative oases" these animals are apparently able to beat back the line of forest, even into regions where moisture conditions are not unfavorable to tree growth.

Such a region, apparently, one lying entirely outside of the glaciated district, was that which may be roughly defined as the portion of southern Kentucky and northern Tennessee lying between the Green and Cumberland Rivers. It also extended into southern Illinois. When first visited by white men it was treeless and covered with grass. The writer has seen in a collection of old maps in the Boston library one of this middle western country printed by John Sinex in Amsterdam, Holland (no date, but presumably in 1721) on which this region is designated as the place "where the Illinois hunt cows." This map is evidently a reproduction of an earlier one in which the legends were in French and where the word rendered "cows" in the later edition was undoubtedly "beufs" in the former. A proper rendition of the original inscription is therefore, "where the Illinois (Indians) hunt buffalo." The first description of this country brought back to English colonists of the Atlantic seaboard, was by a party of hunters, led by a German by the name of Casper Mansker, which setting out from North Carolina in 1769 (See Haywood's History of Tennessee) first broke out of the forest in what is now Wayne County, Kentucky, and there saw stretching toward the west a vast expanse of treeless upland, covered with grass, and grazing countless numbers of buffalo, deer and elk. Not yet having been introduced to the French word "prairie" as descriptive of such a region, these hunters called it "meadow land," and a creek at the headwaters of which by a spring they camped, "Meadow Creek." This creek, sinking a short distance below the spring, reappears again, only to plunge by steep descent into the gorge of the Cumberland River. It still bears the name "Meadow Creek." So excellent was the hunting here, and so eager were the hunters to enrich themselves with skins and pelts that they forgot to return to their homes and families in North Carolina for two years. For this when they did return they received the name "The Long Hunters."

When finally opened up for settlement this region was largely "passed up" by the early pioneers as "poor land," in accordance with the mistaken notion of persons acquainted only with the wooded country to the east that a soil that was not supporting trees must be poor indeed. Hence the name "Barrens," by which the region became known by the early part of eighteen hundred, when the Kentucky legislatures of that period wrestled much with the problem of inducing its settlement. One of the offers made to prospective settlers was the remission of taxes for a certain period of years. The early name for the region is still perpetuated in Big and Little Barren Rivers, and in Barren County, Kentucky, situated near the center of the area.

A geologic examination shows the Barrens to have been nearly coextensive with the outcrop of the cavernous limestone of the Mississippian series. It is a karst country abounding in sinks and caves and underground channels through which rain-water readily sinks and finds its way speedily into the major streams of the region. Hence it suffers much in times of drought. Hence also it would appear, that, aided possibly by forest fires, vast herds of buffalo and deer and elk were able to reclaim it from forest and

convert it into "meadow land." It was here that the buffalo last lingered in Kentucky, a few of them having been seen here as late as 1818.

With the settlement of the country and the extermination of the large wild game, the trees, which still lingered along the major streams, and possibly, also, on the tops of the sandstone knobs which are scattered over the region, began in their turn to reclaim the ground from which they had been driven, until now it is so well wooded that a person traversing the region who was unacquainted with its history would naturally conclude that each farm he sees is but the expansion of a clearing won from virgin forest by the axe of the sturdy pioneer, as elsewhere in Kentucky and Tennessee.

ARTHUR M. MILLER

ASHEVILLE, NORTH CAROLINA

SCIENTIFIC BOOKS

Bodenablagerungen und Entwicklungstypen der Seen. By G. LUNDQVIST. Bd. II of Thienemann's Die Binnengewässer, 1927, 124 pp. 14 pl. Published by E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.

FOR a number of years Swedish investigators have been studying the bottom deposits of lakes in southern Sweden and much interesting and valuable information has been obtained in these studies. The present volume deals primarily with these investigations. The first part treats of the methods of obtaining samples, including descriptions and figures of the apparatus, with the chemical and microscopical methods of studying the material, and with the system of representing the results by diagrams.

These lacustrine sediments are deposited in thin strata and the annual deposit of pollen makes it possible to trace the history of the beds; in this way it has been ascertained that the period of time covered by them ranges from a few hundred years in some instances to a few thousand years in others.

The relative proportions of the component materials serve to characterize the different types of sediments and a key for their identification is given, together with a series of thirteen microphotographs illustrating them.

The sediments are deposited in the form of beds and there is usually a succession of these beds whose sequence is dependent upon the solubility of the chief constituent of the deposit. In some instances the deposits seem to be homogeneous throughout, but through age determinations and by microfossil analyses it can be readily shown that they consist of a series of beds. Several types of bed sequences are shown by means of diagrams. In addition to chemical and biological factors, the character of the beds is affected by certain dynamic factors, such as wind, currents and exposure to wave-action. The final section deals with the regional distribution of lake types in southern Sweden. A bibliography of sixty-nine titles is given.

Die Tierwelt der Unterirdischen Gewässer. By P. A. CHAPPUIS. Bd. III of Thienemann's Die Binnengewässer, 1927, 175 pp. 70 figs.

This volume deals with the animal population of subterranean waters, such as are found in springs and caves. There are three chief sections which consist of (1) general, (2) faunistic, and (3) biological parts. The general part treats of methods of collecting the fauna, the character of subterranean waters and the characteristic environmental conditions existing therein. The subterranean fauna is divided into three ecological groups, namely, (a) Troglobionte, (b) troglophile, and (c) troglozene forms.

The second part consists of a list of the fauna of subterranean waters together with notes regarding the various forms and their geographical distribution. Mollusca and crustacea furnish the largest variety of forms.

The third part, consisting of fifty pages, treats the morphological adaptations of this fauna and the influence of subterranean life on the various organisms; the effect on the eyes and other sense organs, on the color, size and breeding habits are discussed, together with the origin and age of this fauna and the effect of the glacial period upon it. The bibliography includes 194 titles.

C. JUDAY

MADISON, WISCONSIN

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE SPIRALS WITHIN THE TERMITE GUT FOR CLASS USE

INSTRUCTORS in bacteriology often realize that it is not easy on many occasions to find a satisfactory source of spiral-shaped microorganisms for class use. The proper varieties of bivalves are not always available and when one has a sufficient number of these at hand, one can not be certain that one will find satisfactory spiral material within them. Many also have made it a habit to look over students in an endeavor to find a marginal gingivitis since this condition yields most beautiful fields for direct smear or for the dark field. Young people, however, show this disease in rather limited numbers.

One of us (S. F. L.) while making a study of the

protozoan fauna of the termite gut[1] some years ago was impressed by the fact that the intestinal contents of these forms contain immense numbers of spiral organisms. It then occurred to us that these insects might offer a satisfactory source of supply of spirilla for class use in bacteriology. Repeated dissections according to technique which follows showed that material both for smear preparation and for dark field was rendered abundant immediately and with spectacular results. The wide distribution of termites over the United States renders them readily available to laboratory instructors in many parts of the country and careful search will discover them in practically all regions.

The termites of the United States which are favorable for this use and which are common enough to furnish laboratory material over any considerable area belong to three genera: *Termopsis* Hagen, the commonest west coast termite; *Kalotermes,* several species of which are found in the southwestern, southern and southeastern states; and *Reticulitermes,* with numerous species, which has an extensive range including the whole of the United States with the possible exception of certain of the northernmost central states. In the Bay Region of California all three genera are present. Of these genera, *Termopsis* and *Kalotermes* live entirely in wood, the former in decaying wood, the latter in sound, but dead wood, such as stumps or dead parts of living trees, in telephone poles and, further south, in house beams. *Reticulitermes* lives in the earth from which it attacks sound wood. It is the cause of considerable economic loss due to its attacks on wood of buildings, etc.

The genera have been named in the order of decreasing size and increasing difficulty of laboratory culture. The difficulties encountered in laboratory culture of the termites arise from the necessity of considerable humidity together with the susceptibility of the organisms to fungus attack. *Termopsis,* the largest of these termites, is also the hardiest. Living as it does in fungus infested wood it seems to have developed a resistance to fungus attack. The simplest method of keeping laboratory cultures of *Termopsis* is by placing double cones of filter paper in finger bowls set in battery jars or museum jars. The larger jar should contain half an inch of water and must be covered with a glass plate. After some time on the filter-paper diet the wood particles disappear from the intestinal contents, which makes it easier to make smears. A more satisfactory arrangement for long periods or for the other genera is a series of mason jars with rubber stoppers pierced each with two glass tubes connecting by rubber tubes with the other jars, one of which contains water. Here filter-paper cone may be used or, better still for long cultures, pieces of the wood taken with the colony.

The whitish-headed individuals (nymphs of *Termopsis* and *Kalotermes,* workers of *Reticulitermes*) contain the most luxuriant flora. When material is needed the termite may be placed on a surface and held quiet by a probe pressed gently on the thorax. The extreme tip of the abdomen is then seized in fine-pointed forceps and by a gentle continuous pull the intestine may be removed. When teased the contents escape, including wood or paper fragments, great numbers of Protozoa, and the microorganisms. The lumen is lined with a close coat of spirals. Teased pieces of it mounted in Locke's or physiological saline present a beautiful picture. The material thus obtained may be mixed with two or three drops of sterile physiological saline upon a microscope slide and from this smears may be made immediately. Following air drying, they may be fixed by heat and then distributed to the students. Ordinarily Ziehl-Nielsen carbol fuchsin diluted six to ten times with water gives a satisfactory stain. The finest results, however, are to be obtained with the dark field condenser using the fresh gut contents diluted somewhat with sterile physiological saline.

Beginning with Leidy the students of the Protozoa of the termite have noted the spiral organisms which abound in the gut. Leidy, in his first paper,[2] spoke of the "spirillum" and later[3] named it *Vibrio termitis.* Grassi and Sandias[4] speak of spirilla in European termites. Dobell[5] describes *Spirochaeta termitis* from Ceylon termites, which he identifies with Leidy's species. More recently they have been discussed both by Cleveland[6] and by Damon.[7] Thus, we make no claim that these observations are original with us. We do desire to call the attention of laboratory workers and instructors to the fact that there is a source of spiral material which is easily available here in the United States.

T. D. BECKWITH
S. F. LIGHT
UNIVERSITY OF CALIFORNIA

[1] Light, S. F., *Univ. Calif. Publ. in Zool.,* 1926, xxix, 150.

[2] Leidy, J., *Proc. Acad. Nat. Sci.,* Philadelphia, 1877, 141–149.

[3] Leidy, J., *Jour. Acad. Nat. Sci.,* Philadelphia, 1881, viii (New Series), 425–447.

[4] Grassi, B., and Sandias, A., *Atti Accad. Gioenia Sci. Nat. Catania,* 1893, vi (series 4), Mem. XII, and 1894, vii (series 4), Mem. I. English translation in *Quart. Jour. Micr. Sci.,* xxxix, 245–315 and xl, 1–75.

[5] Dobell, C. C., *Spolia Zeylanica,* 1910, vii, 65–86.

[6] Cleveland, L. R., *Quart. Rev. Biol.,* 1926, i, 51–60.

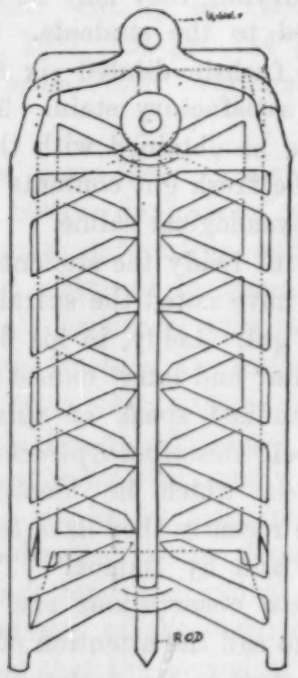
[7] Damon, S. R., *Jour. Bact.,* 1926, xi, 31–36.

A COVER-SLIP CARRIER

THE apparatus described below has been used for some time by the author for carrying numerous cover-slips through the fixing, dehydrating and staining fluids. Its advantages are: (1) It carries many cover-slips at the same time. (2) It is easy to move from solution to solution. (3) It necessitates much less material in the end. (4) It gives a like treatment to every piece of tissue on the cover-slip.

It is a small glass cage with one side open for the slip to be inserted. This opening is closed by a glass rod. The shelves are made of glass prongs that do not quite reach the middle and are slightly tilted so as to drain to the main bars. A small handle surmounts the entire structure.

In moving from one solution to another the cage was rested on absorbent paper, thus allowing excess fluid to drain off. Small glass tumblers with ground glass tops were used for reagents.



Mr. Morgan, of Eimer and Amend, was extremely helpful in changing my design for a metal cage to a glass one and can give any necessary information.

HUGH H. DARBY

NEW YORK UNIVERSITY

SPECIAL ARTICLES

ON THE CHANGE FROM THE CONVECTIVE TO THE SPARK DISCHARGE OF THE MUCRONATE ELECTRODE

Apparatus. This is the same as described in my last paper,[1] E E' being the electrode discs (2 cm. in diam.) of the spark gap x of a small electrostatic machine. E' is provided with an axial tube leading to the interferometer U-gauge beyond U, for measuring the pressure of the electric wind from the needle point y protruding a little beyond E. S is the head of the micrometer screw by which y may be set in length until the pressure at U just vanishes and the convective discharge from E to E' (wind) breaks up into the pressureless spark discharge. If thereafter y increases but .1 mm., the pressure at U instantly becomes a maximum, and relatively enormous, as heretofore explained (see graph A). Hence the particular position of S in question may be called the critical set.

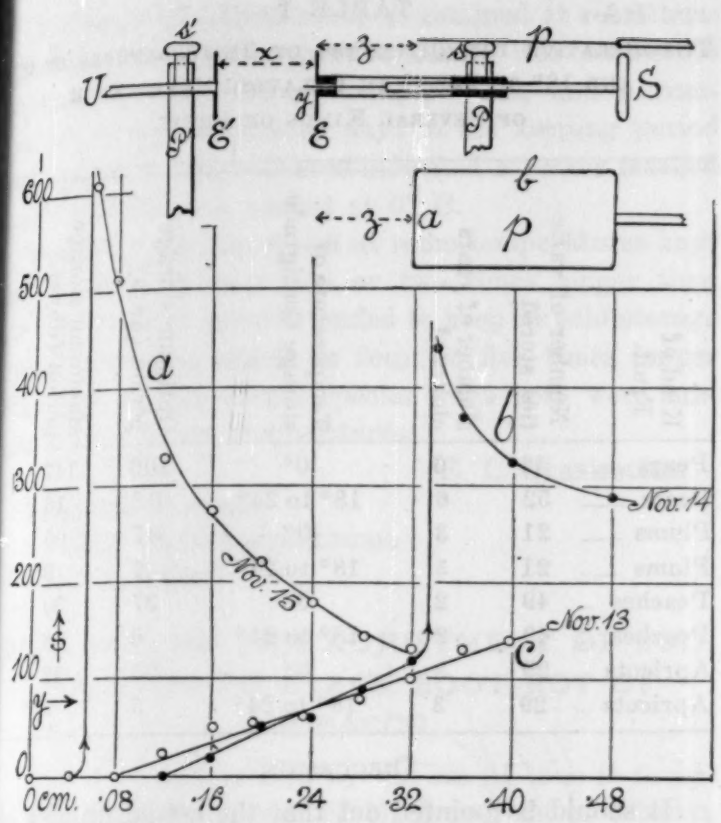
Observations. With the apparatus in this condition, I noticed (in the dark) that if the finger touched the set screw s of the post P, the strong electric wind E to E' immediately broke up into a hollow cylinder of sparks implying absence of all pressure at U. A faint brush was also usually seen at s' of the post P'. Removing the finger restored the wind and its pressure at U. At such times the cathode needle point, only, is faintly luminous. The experiment may, of course, be indefinitely repeated. On touching the anode at s' the behavior is similar, but much less marked. Sparking is apt to persist for the fraction of a second after withdrawing the finger, evidencing a kind of inertia.

It seemed probable that the cause of this occurrence would be the increased capacity of the electrode E and I therefore installed apparatus hoping to detect a relation between the extrusion y of the needle point, and the capacity increment in question. This I was unable to do consistently, as all capacities from 3×10^{-6} m.f. to about 10^{-3} m.f. often seemed to be equally effective in changing the wind into a spark succession. The larger capacities, however, admitted of a larger range of needle extrusion y. After long sparking the phenomena often seemed to tire.

As very small capacities were needed, I provided a set of rectangular proof planes p all about $b=6$ cm. long and of varying width a (see figure). These were made to touch the set screw s in succession.

The effect of this contact for $a=2$, 4, 5, 6 cm. was merely to produce momentary initial sparking, after which the wind pressure reappeared in spite of the presence of the plane. With $a=7$ cm., however, the plane in contact at s was able to hold the spark succession permanently, provided the z distance (see figure) exceeded about 5 cm. For small z, pressure again appeared. For a = 8, 9 cm., etc., the plane became more and more dominating, and for $a=10$ cm.

[1] SCIENCE, XLV, 1927, p. 448.



hold the spark even for $z < 5$ cm. and it sufficed to touch the prime conductor of the machine with the proof plane anywhere, however remote. The finger contact was exceptionally effective, with the radiating glow at s' very marked. These data give the general character of the experiment. They will vary somewhat in different adjustments. When the proof plane approaches s, a small spark jumps across to it, and it may be argued that this is probably what initiates electric oscillation between E and E', and thus breaks up the convection current from E to E'. Moreover, a certain length z of the stem between E and P seems to be needed, supplying adequate self induction together with the capacity, to insure permanence of electric oscillation.

In the presence of the proof plane, y must be increased to again initiate the convection current. To reproduce convection when the finger touches P, y had to be increased about .04 cm. After the removal of the plane, y must again be decreased to obviate convections; *i.e.*, the apparatus eventually oscillates under its own capacity. The behavior is in a way similar to the sensitive flame in acoustics, in which a smooth column begins to oscillate if stimulated. Just why oscillation ceases when y is too long by almost infinitesimal amounts, I have not fully made out; but one is tempted to infer that the electric circuit in such a case is in a dead-beat, or a-periodic condition, with too much friction somewhere probably at and near the needle. From this viewpoint, to increase y is to increase the electric resistance of the circuit.

Incidental variations. The data which I have given refer to what may be called the normal (cathode) behavior of the machine and appurtenances. The pressure of the convection wind may then run up to over 600×10^{-6} atm. At other times, which occur incidentally, the convection is always intermixed with more or less sparking and winds not much exceeding 100×10^{-6} atm. in anodal pressure, may be the highest obtainable, while the critical extrusion (y) of the needle may be five times greater at the maximum pressure. There may be no cusps in the graph. This is a source of much confusion, for the clear cut evidence of one day may be negatived on the next. On such off days the effect of capacities, etc., is also varied. The spark succession is a brilliant line, not cylindrical, and there is often uncertainty as to the critical set of the needle electrode.

Three examples of y s graphs (s being the wind pressure in 10^{-6} atm.) obtained on consecutive days, the machine (as such) working equally well in each case, are given in the diagram. One observes that the graphs are displaced bodily, high s and low critical y here going together.

Later it was found (with double micrometer electrodes) that while the curve a is the true cathodal graph, curves b, c, are types of the corresponding anodal graphs and that passage from one to the other resulted from spontaneous changes of the polarity of the electrical machine. Furthermore, when the critical set of the cathode is sharply made, the proof plane, if charged negatively, need not touch the cathode conductor, but is active (as by induction) from distances up to 10 cm. on either side of the spark gap x. Pursuing this test, I then used the usual negatively charged hard rubber rod and found this capable of changing the quiet convection current into a spark succession from a distance of even half a meter in any plane or orientation above or below the spark gap and on either side of it. A positively charged glass rod, on the contrary, had no observable effect anywhere. This puts a new face on the phenomenon, particularly as the increment of field impressed at the spark gap by the hard rubber rod is relatively small at best, and may actually be reversed, since the rod acts equally well on both sides of the spark gap. Finally, while the anodal behavior is in general similar, the positively or negatively charged rod has no effect on it in any position. The emission of positive or of negative electrons is thus distinguished by an extrusion, y, 4 or 5 times larger in the former case.

CARL BARUS

BROWN UNIVERSITY,
PROVIDENCE, R. I.

COLD STORAGE VERSUS ROOM TEMPERATURES ON KEEPING QUALITIES OF FRUITS

IT has become generally recognized that cold storage temperatures of 0° C. tend to retard the ripening and thus prolong the period of edibility of most fruits as contrasted with room temperatures of 18° to 24° C. (Powell,[1] Magness,[2] Overholser,[3] Carrick,[4] and others.)

The fact, however, does not appear to be so widely recognized that the better the intrinsic keeping quality, at room temperatures, of the species of fruit stored the greater the *proportional relative* delay in senescence brought about by cold temperatures.

METHOD OF PROCEDURE

Data obtained with a number of varieties of several species of fruits have been utilized to indicate the average keeping period as affected by storage at 0° and at 18° to 24° C. The fruits were handled and observations made as previously described in other publications (Overholser, 1922; (with L. P. Latimer), 1924).

With the fruits stored, an optimum period and a maximum period was determined. The *optimum storage period* referred to the average number of days the fruit could be stored and upon removal possess good quality and marketability. The *maximum storage period* referred to the time beyond which it was unsafe to keep the fruit in storage, although it was still in fair to good condition, because of likelihood of loss of quality, softening of texture, susceptibility to rot organisms, tendency to wilting and rapidity of breakdown subsequently.

Three pickings of the varieties of each kind of fruit were stored, the first being made soon after the beginning of the commercial harvest period, the second about the middle, and the third picking shortly before the close of the commercial harvest period for the variety.

EXPERIMENTAL DATA

Data showing the relative effectiveness of 0° C. and 18° to 24° C. in delaying the senescence of varieties of pears, plums, peaches and apricots, are presented in Table 1. The intrinsic keeping qualities of the species of fruits studied are generally considered by growers and shippers to be about in the order named, with the pears as a rule possessing the longest period, and the apricots the least period of marketability.

[1] *U. S. D. A. Bur. Plt. Indus. Bul.* 40 pp. 9–26. 1903.
[2] *Jour. Agr. Research* 19: pp. 473–500. 1920.
[3] *Calif. Agr. Exp. Sta. Bul.* 344. pp. 426–463. 1922.
[4] *Cornell Memoir* 81, pp. 1–54. 1924.

TABLE I

THE RELATIVE EFFECTIVENESS OF TEMPERATURES OF 0° AND 18° TO 24° C. IN DELAYING SENESCENCE OF SEVERAL KINDS OF FRUIT

Kind of Fruit	Number of varieties stored	Number of years observed	Temperature of storage Centigrade	Optimum storage period (days)	Maximum storage period (days)
Pears	52	6	0°	106	147
Pears	52	6	18° to 24°	12	16
Plums	21	3	0°	47	65
Plums	21	3	18° to 24°	7	9
Peaches	49	2	0°	37	50
Peaches	49	2	18° to 24°	6	8
Apricots	29	3	0°	23	32
Apricots	29	3	18° to 24°	5	6

DISCUSSION

It should be pointed out that the actual number of days before senescence varied greatly, depending upon the variety, even within a species, and varied somewhat for a given variety depending upon the maturity when harvested, the region where grown, the season and other factors. Of course, some varieties of a given kind would keep much longer and others much shorter periods of time than the averages given. Nevertheless it is believed that the data indicated the average difference in keeping qualities of the several kinds of fruits.

It should also be pointed out that certain varieties within a given species kept relatively long at 18° to 24° C. and comparatively short periods of time at 0° C. Furthermore, with other varieties of the same species the reverse was true. The deductions, therefore, apply only to the average response of the varieties of a given species as contrasted with the fruit of another species.

DEDUCTIONS

The pears, which had the longest period before the approach of senescence, kept about nine times longer at 0° C. than at 18° to 24° C. The plums, which possessed on the average the next longest period before senescence, kept about seven times longer at 0° C. than at 18° to 24° C. In a similar manner peaches kept six times and apricots only five times longer at 0° than at 18° to 24° C.

The data show that the effectiveness in retarding senescence of cold storage temperatures (0° C.) as contrasted with temperatures of 18° to 24° C. varied, depending upon the inherent keeping qualities of the species.

The longer the fruit could be retained at room temperatures the greater proportionally was senescence delayed by cold storage temperatures, and a comparatively few additional days in the keeping period at the higher temperatures indicated a rather marked additional keeping period at 0° C.

Fruit of a species which at room temperatures kept on the average only one or two times longer than fruit of another species tended to keep at cold storage temperatures as much as four or five times longer than that of the second species when both were subjected to the low temperatures.

E. L. OVERHOLSER

NORTHERN BRANCH
COLLEGE OF AGRICULTURE,
DAVIS, CALIF.

RELATION OF THE ADJUSTMENT OF SOIL REACTION TO BLACK ROOT-ROT OF TOBACCO

A SOIL made less acid by the use of lime is favorable to the development of black root-rot of tobacco, caused by the fungus *Thielavia basicola* Zopf. Anderson, Osmun and Doran[1] found that black root-rot caused practically no loss in a soil more acid than pH 5.6 and that it caused severe loss in a soil less acid than pH 5.9. In soil having a reaction too nearly neutral, loss caused by black root-rot may continue to increase for at least four years after the application of lime. A quick method of increasing soil acidity is needed so that tobacco may be grown profitably on such soil. The results of experiments in 1926 on the relation of acidifying chemicals to the hydrogen ion concentration of the soil and to the control of black root-rot are here summarized.

Acids were applied to soil of known pH value infested with *Thielavia basicola,* and in such soil tobacco was grown. Results were measured in terms of effect on pH value of soil, growth of plants and infection of roots.

Equivalent quantities of nitric acid and of sulphuric acid had practically the same effect on the pH value of the soil, lowering it in proportion to the quantity of acid used. When soil was acidified by the addition of a little dry soil which had previously absorbed concentrated sulphuric acid or nitric acid, the pH value of the soil was lowered about as much as when equivalent amounts of these acids in water were applied directly to it.

All acids used lowered the pH value of soil when first applied. But it soon reverted toward or to the original pH value in the case of the organic acids used—citric, lactic, malic, tartaric and acetic.

Orthophosphoric acid had much less effect in lowering the pH value of soil than did equivalent amounts of nitric acid or sulphuric acid. When the only object was to increase soil acidity, nitric acid or sulphuric acid used alone was as efficient or more efficient than when either of these acids was applied together with orthophosphoric acid to the soil.

Field experiments were conducted in a soil of the Gloucester Series, with a pH value of 5.9, severely infested with *Thielavia basicola.* During the growing season, the pH value of this soil was lowered 0.10 by 200 lbs. inoculated sulphur per acre, 0.15 to 0.20 by 400 lbs. inoculated sulphur per acre, and 0.15 to 0.25 by a combination of 1,800 lbs. sulphuric acid and 400 lbs. orthophosphoric acid per acre. The quantity of acid necessary to apply to a soil to produce a definite increase in soil acidity depends on the buffering of the soil and can not be exactly predicted for any other type of soil than that on which it has been determined experimentally. In this field the pH value of the soil was lowered enough by the acid treatments to be unfavorable to infection of roots by Thielavia. The yield of tobacco in treated plots, as compared with yield in plots not treated, was increased 28 per cent. by 200 lbs. sulphur, 34 per cent. by 400 lbs. sulphur and 58 per cent. by 1,800 lbs. sulphuric acid together with 440 lbs. orthophosphoric acid per acre.

In pot experiments, the increases in soil acidity resulting from the application of nitric acid and of sulphuric acid were equally efficient in preventing severe black root-rot. The only organic acid used which protected tobacco against infection was acetic. Plants were free from black root-rot or showed only a trace in soil infested with Thielavia to which acetic acid was applied. Acetic acid has no lasting effect on soil reaction and its effect is probably to partially sterilize the soil.

The application of orthophosphoric acid to soil infested with Thielavia resulted in root infection more severe than that on check plants. Orthophosphoric acid is seemingly as favorable to infection by Thielavia as is lime. In the presence of abundant orthophosphoric acid, black root-rot may be severe in relatively acid soils. The use of orthophosphoric acid together with sulphuric acid or with nitric acid usually resulted in more black root-rot than when sulphuric or nitric acid was used alone. But in spite of the severe root infection which it induced, orthophosphoric acid resulted in a great increase in the growth of plants.

The acids were all more toxic to tobacco plants in

[1] Anderson, P. J., A. Vincent Osmun, and W. L. Doran, "Soil Reaction and Black Root-rot of Tobacco," *Mass. Agr. Expt. Sta. Bul.* 229, 1926.

poorly buffered than in well buffered soil. The acids most toxic to germinating seeds and seedlings of tobacco were citric, malic, tartaric and nitric acids. Acetic acid was the least toxic to plants of the organic acids. Nitric acid was much more toxic to plants than was sulphuric acid.

When soil reaction is adjusted by acids, the germination and growth of plants can not be correlated with pH value of soil except for each acid considered separately; the optimum pH value of soil for growth of the plant depends on what acid was used to adjust the soil reaction.

WILLIAM L. DORAN
MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION

ENTEROMORPHA AND THE FOOD OF OYSTERS[1]

A NUMBER of investigators have suggested the probability that spores of algae may at times enter into the food supply of oysters, but the possible importance of this element under certain conditions seems not to have been realized. The purpose of this note is to point out that this factor is at times of very great significance to the oyster and presumably to other plankton feeders, and to suggest one reason why its importance has been underestimated. The observations upon which it is based were made in Barnegat Bay, New Jersey, during the summer of 1927, in connection with the oyster studies conducted by the Department of Biology of the New Jersey Agricultural Experiment Station.

Of the three species of Enteromorpha occurring in Barnegat Bay, *E. plumosa, E. intestinalis* and *E. compressa,* the last named is commonest, growing everywhere on shells and stakes, and also attached directly to the mud of the shores of the salt marshes which line a large part of the Bay. In 1927, the spring vegetative growth of this species was largely completed by June 15, and zoospore discharge had commenced, continuing at frequent intervals until the end of July, by which time practically the entire substance of the fronds, excepting only the old cell walls, had been converted into nannoplankton. During this period zoospore discharge took place an hour or two after sunrise on every quiet, clear day, the zoospores swarming actively until toward noon, when they began to settle. Thus there were four or five hours on every such day when the water contained countless swarms of these organisms. The zoospores are pyriform, with four flagella and a single chromatophore, mostly from 5 to 7 μ long and from 4 to 6 μ broad, although there is some variation beyond these limits. It is not surprising that cells as small as this are not present in net collections, but it is surprising that so little evidence of their presence is seen in examination of the stomach contents of oysters living and feeding in immediate proximity of the fronds. In order to see whether the zoospores are ingested, an oyster was placed in an aquarium together with a mass of Enteromorpha just about to discharge zoospores. The shells of the oyster were open most of the morning and it was evidently feeding actively. Shortly after noon it was opened and the stomach was found to be packed with a bright green mass of food material, yet when examined under the microscope, the mass contained few recognizable zoospores, the great majority of the organisms visibly present being either diatoms or peridines. There were, however, numerous masses of greenish matter immersed in mucus to be seen, and careful study of these under an oil immersion objective showed unmistakably that they were composed almost entirely of the partially disintegrated zoospores, which were obviously being digested much more rapidly than the larger and better protected forms.

As a further test, several oysters were kept out of water until their stomachs were largely emptied of food. They were then opened, and drops of the nearly colorless stomach contents were placed on slides to which Enteromorpha zoospores and small diatoms from cultures were added. Similar drops were added to small quantities of the same organisms in vials. In all cases, visible disintegration of the zoospores began within fifteen minutes; they were largely destroyed at the end of an hour, and only a few traces of them were left at the end of two hours. During the same time, there was no perceptible alteration in the appearance of the diatoms. Evidently, by reason of their very thin cell walls and minute size, the zoospores are quickly digested, while the better protected diatoms and peridines, and even such forms as Euglena, resist digestion for a much longer period. The enormous numbers of such spores liberated and their remarkably rapid assimilation suggest that under the conditions existing in Barnegat Bay the zoospores of Enteromorpha form an important element in the food of plankton eaters during such times as they are being discharged. To these must be added the spores of species of Ulva, Monostroma, Ectocarpus and Pylaiella, certain of which are at least locally abundant in the Bay, and not only add to the total amount of such food present, but materially lengthen the period during which it is available.

G. W. MARTIN
THE STATE UNIVERSITY OF IOWA

[1] Publication No. 9, N. J. Oyster Investigation Laboratory.

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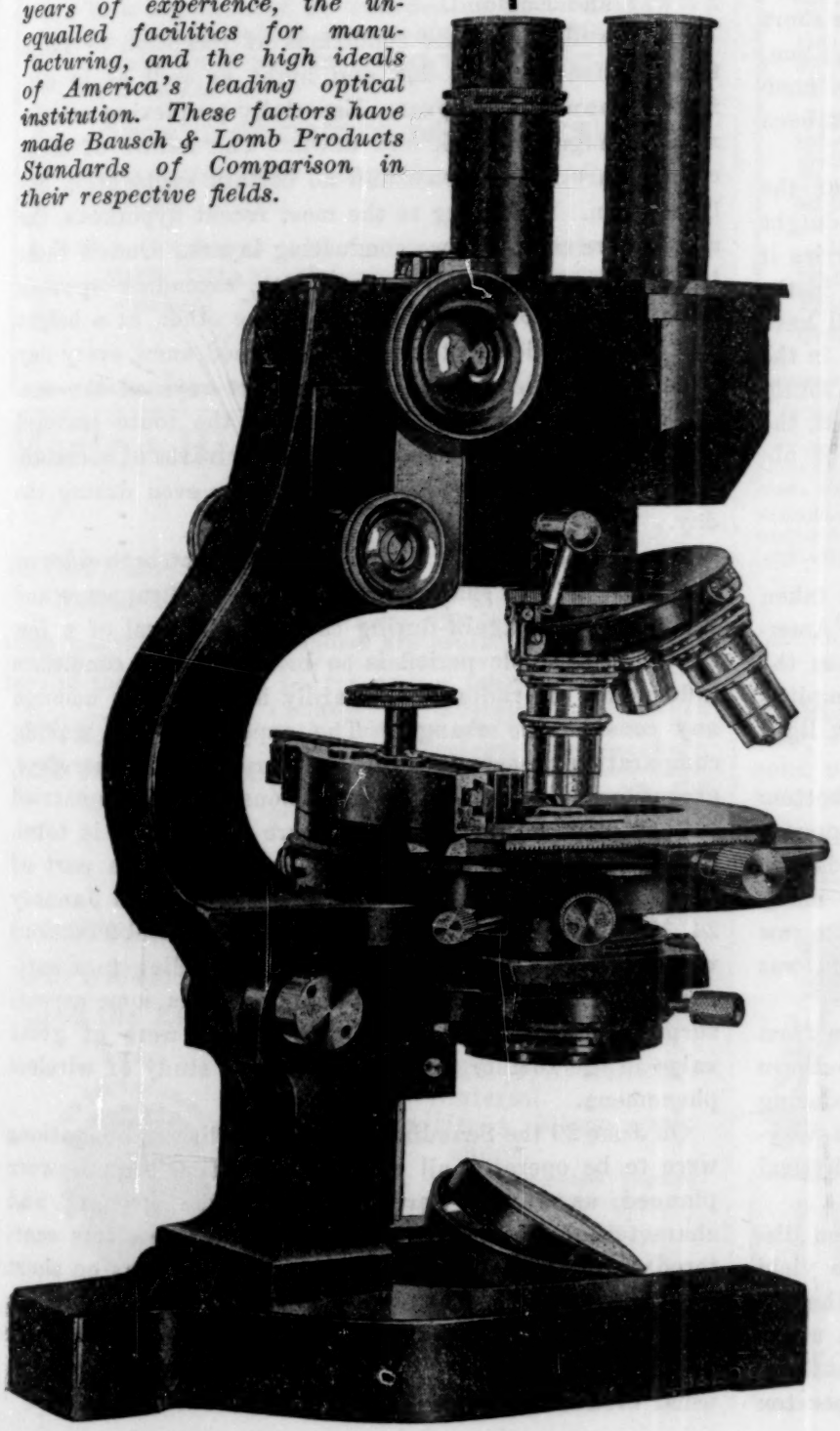

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SCIENCE NEWS

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THE PONS-WINNECKE COMET

PONS-WINNECKE comet can now be seen with the naked eye. This celestial visitor is now getting closer to the earth than any other comet within the memory of the oldest astronomers. On June 27 it was but 3,500,000 miles away. Cloudy weather has kept the big telescopes of the Yerkes Observatory from being trained on it recently. However, on June 19, Professor George Van Biesbroeck observed it and estimated that it was of the four and a half magnitude. As objects as faint as the sixth magnitude can be seen without optical aid, the comet is now easily visible to the naked eye.

According to Professor E. B. Frost, director of the observatory, the comet was then seen as a diffused patch of light about the size of the full moon. There is a short streamer projecting from it in the direction of the sun, he said, but this is not developing into a tail. On none of its previous visits, at six-yearly intervals, has it been observed to have a tail.

When observed on June 19, the comet was near the bright star Vega, which is nearly overhead about midnight towards the end of June. By June 25 its orbit carries it to the long end of the Northern Cross, visible high in the eastern sky late in the evening. By July 1, it will have moved to a position near the bright star Fomalhaut, in the Southern Fish. This group will be seen low in the southern sky in the early morning at that time. After that, the comet will move far south, and out of the view of observers in the northern hemisphere.

OIL IN THE MUD OF THE SEA

A LONG look ahead in the oil industry is being taken by Dr. Parker D. Trask, research associate of the American Petroleum Institute. Backed by a grant from the John D. Rockefeller fund of the institute, he is sampling sea-bottom muds and sands in order to throw new light on the question of the origin of petroleum.

Dr. Trask's attention was turned to the sea bottom by the fact, long known to geologists, that the supposed source beds of most of the present-day oil fields are marine in origin. Though these were laid down many millions of years ago, they must have had at least the raw materials of oil scattered through them then, which was later concentrated in the pools now being drained.

Samples of sea-bottom muds and sands were taken from shoal waters in two regions, off the coasts of southern California and of North Carolina, and their oil-producing capacity determined by distillation, by burning out everything combustible, and by other chemical and physical methods.

"All types of sediments, from clay to sand, upon distillation produced oil," Dr. Trask reports. "The yield was low, and in general varied in amount with the degree of fineness of the sediments, ranging from a maximum of 2.7 gallons per ton in a clay-silt to almost nothing in a sand. This maximum yield of 2.7 gallons per ton is but 5 or 10 per cent. the amount obtained from the better grades of oil shale, which run from 30 to 50 or even more gallons per ton."

The work so far carried on is regarded merely as a preliminary reconnaissance, to be followed by more exhaustive research both in the field and the laboratory.

ECLIPSE OBSERVATIONS ON RADIO PROBLEM

EXTENSIVE observations of the influence of the rays of the sun on radio waves were planned for the total eclipse of the sun, when in the early morning of June 29 the eclipse spread twilight over large sections of Sweden, Norway and England.

As is well known the conditions of reception of radio transmission vary by day and night as well as in different seasons of the year. Especially perplexing are the rapid changes at dusk and dawn. The nature of these changes are little known and no certain explanation has been given. According to the most recent hypothesis, the atmosphere contains two conducting layers. One of these is permanent and of immense width, extending upwards from a height of about 50 miles. The other, at a height of 25 to 35 miles, is thinner and formed anew every day under the influence of the ultra-violet rays of the sun. At daylight the latter layer decides the route traveled by the radio waves. Possibly, however, waves of a certain length reach the outer, permanent layer even during the day.

The eclipse creates a border of twilight at both sides of a narrow strip of shadow. The sun rises, disappears and becomes visible again during the short interval of a few hours. The whole period is so brief that the conditions influencing the radio waves hardly have time to undergo any considerable change. The opportunity of making comparative observations and measurements is, therefore, exceptionally favorable. Observations were to be carried on not only within the zone where the eclipse is total, but also at points which are touched by only a part of the shadow of the moon. During the eclipse on January 24, 1925, which was total in New York, such observations were conducted on a large scale and according to a carefully prepared plan. The interesting and in some aspects surprising results achieved at that time were of great value in the further development of the study of wireless phenomena.

On June 29 the Scandinavian and English radio stations were to be operated all night. Exact time signals were planned, as well as certain symbols, the strength and character of which could be recorded by receivers scattered over a large area. Amateur experimenters on short waves were to cooperate two and two across the route traveled by the shadow of the moon. Even the ordinary radio fans were invited to participate, listening in on the usual broadcasting wave lengths.

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RADIO AIDS TO NAVIGATION

WAYS in which radio is being used to guide aircraft over Europe will be studied by Dr. J. H. Dellinger, chief of the radio section of the U. S. Bureau of Standards, who is sailing for Europe on July 2.

Commercial aviation routes abroad are becoming well established, and a variety of radio devices are in use. On the London to Paris route, for instance, airplanes carry radio transmitters. Signals broadcast from the air enable direction-finding stations on the ground to locate the plane and to inform the pilot by radio-telegraphy where he is.

Application of radio to commercial aviation is in a formative stage in this country. The Department of Commerce is now just at the beginning of establishing beacon systems. Three types of radio aids have been investigated by the Bureau of Standards. The first is a directive radio beacon which sends out a special type of radio beam by which pilots can follow the designated course in total darkness or fog. The second type is radio telephony from the ground to the aircraft. The third is a system of marker beacons, like mile posts. There are now four aircraft radio beacon stations established or under construction in this country.

Dr. Dellinger will compare standards of freqnency or wave length at European radio stations, using a special instrument for measuring the frequencies. This data will be used in connection with the parceling out of frequencies at the international radio conference to be held in Washington next autumn.

NEW ELECTRIC CABLE

A NEW type of electric cable for small currents, such as those used for sounding bells and buzzers and for starting and stopping machinery, has been invented by a Hungarian electrical engineer in Berlin, Oscar Nagy. It does away with the necessity for having push buttons at set points, for if the cable is squeezed at any place throughout its length the circuit is completed and the current does its work. This is accomplished by having the wires woven into a sort of loose braid, separated by an elastic non-conductor, which permits contact when pressure is applied.

Many uses are suggested for the new cable. It is expected to find a large use around complicated machinery, where threatened accidents to either operator or material demand instant stopping. Since it can be operated with feet, knees, elbows, or any other part of the body, its advantage over ordinary types of switches and levers is obvious. Hidden beneath carpets or otherwise concealed, it is expected to be useful in burglar alarm systems. Strung along trenches, or along the sides of naval vessels, it will enable officers to signal to their men from any point, and by rapid successive pressure messages can be transmitted in ordinary Morse code, making it an emergency telegraph system.

An especially interesting safety application is found in its use in mines and quarries, where a fall or slide of rock automatically sounds its own emergency signal.

CALIFORNIA GRASSHOPPERS

THE plague of grasshoppers now threatening the grain region of northern California is made up of insects similar to the plague of locusts that afflicted Egypt in the days of Moses. True locusts are all winged grasshoppers. In seasons favorable for their hatching, they often appear in dense swarms, following a definite line of march, or rather of flight, and destroying every green thing that lies before them.

Officials of the Bureau of Entomology of the U. S. Department of Agriculture have stated to Science Service that while the present California outbreak may be a little more severe than usual, it is by no means an isolated or unusual event. Every year there is more or less of a grasshopper problem in the California grain belt, at about the time when the wheat is in the "dough" stage of ripening. The half-hardened grains seem to represent the grasshoppers' idea of the ideal food.

The grasshoppers hatch in the spring, from eggs laid in the ground during the previous fall. Eggs laid in plowed land are of course exposed to the weather and destroyed; but alfalfa fields normally stand for a number of years without plowing, and these make favorable beds for the hoppers' eggs.

It is emphasized that the report of "seventeen-year locusts," that spreads abroad whenever there is an outbreak like the present one, has nothing whatever to do with grasshoppers. The insects commonly called seventeen-year locusts are really seventeen-year cicadas, and are much more nearly related to squash-bugs than they are to grasshoppers.

AN AZTEC CALENDAR STONE

THE calendar stone of Montezuma and other interesting relics of the ancient Mexican civilization have been uncovered during repairs made on the National Palace in Mexico City which houses the executive offices of President Calles. The objects are now in the National Museum adjoining the palace.

The calendar stone, the largest of the carvings found, is said by Professor Ramon Mena, head of the department of archeology of the museum, to be the votive offering of Montezuma II to the sun in return for having started auspiciously the cycle of fifty-two years beginning in 1507, hardly a dozen years before the coming of the Spanish conquerors and the fall of the Aztec empire. The preceding cycle, beginning in 1455, is represented as having been initiated with famines and other calamities.

On the sides of the huge stone block are the carved seated figures of priests. One, extending offerings, represents the Emperor Montezuma. On the top surface of the stone are symbols of sacrifice and figures of fire serpents. On the back surface are carved symbols representing the foundation of Tenochtitlan, the ancient Mexico City, and its development under the protection of the god of rain and harvest. The front surface represents the sun on the right and Montezuma on the left.

When the Spanish conquerors entered ancient Tenochtitlan, Montezuma was made a prisoner in his own palace. After his death and after the final defeat of the Aztecs

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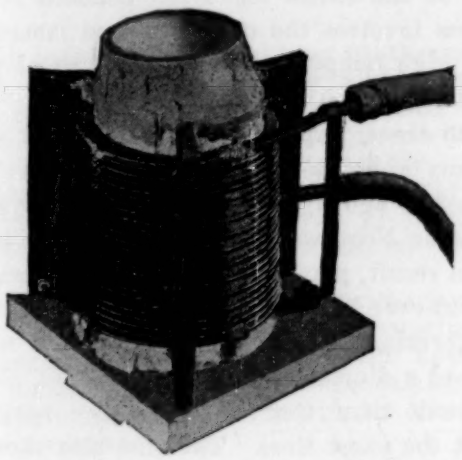

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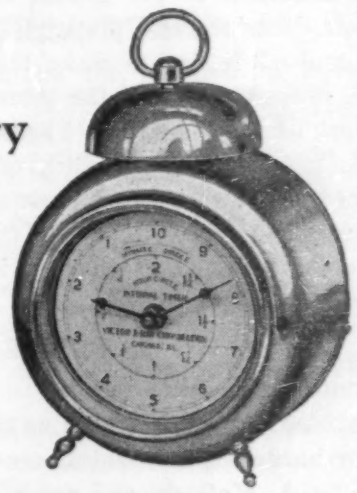

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under another leader early in the sixteenth century, the great temple was destroyed and the city razed to the ground. On the site of Montezuma's palace, Cortez built his own, and the present National Palace was enlarged from that. Much of the building material used came from the ruins of Aztec temples, and the relics which have been recently placed in the National Museum were dug from the ancient foundations laid down by Cortez.

QUACK PSYCHOLOGISTS

PSEUDO-PSYCHOLOGISTS, who promise, like fairy godmothers, to turn every-day human beings into fascinating personalities or into great financial successes, are creating large groups of discontented individuals, according to Dr. E. A. Shaw and George E. Gardner, of the Harvard University Psycho-Educational Clinic.

These two clinical psychologists state in a report to the National Committee for Mental Hygiene that "character analysts" and "practical psychologists" are responsible for many of the dissatisfied, badly adjusted cases that come to the Harvard Clinic. Gilt edge promises made to all, irrespective of ability and training, lead individuals to false hopes and discontent with kinds of work for which they are suited. And repeated failures to attain the heights so glowingly described as well within reach can lead an individual to serious mental upsets.

The psychological quack, half informed concerning scientific psychological principles, undertakes in a conference or by lectures, and for no small fee, to advise men and women about their mental and vocational ills. The two Harvard psychologists explain that "these men, we maintain—and their numbers are growing day by day—are a detriment to the mental health of the community. In their doctrines and platitudes there is just enough of truth and of falsity to make them dangerous."

One serious result of the situation pointed out is that the work of the "analysts" becomes confused in the eyes of the public with the work of well-trained vocational advisers and directors of personality clinics who conscientiously and carefully study the individual who comes to them for help and who advise him according to his real possibilities.

ITEMS

IRIDIUM, a metallic element in the same chemical group as platinum, and often used as the tip for fountain pens, is the hardest pure metal, according to tests recently made by A. Mallock, and reported in *Nature*. Molybdenum is the next hardest, with tungsten third. Nickel is the hardest of the common metals as it ranks fifth, the rare metal rhodium coming in fourth. These refer only to pure metallic elements, for some alloys, such as steel with a high percentage of carbon, rank higher than any. The softest of the metals tested proved to be thallium, as it ranked number 24, lead being 23 and tin 22. Gold is 18, silver 15, palladium, which is in the same group as platinum and iridium, 14, aluminum 12, copper 11 and iron 10.

METHANOL, the synthetic chemical replica of wood alcohol which for the past two or three years has figured largely in chemical imports from Germany, is now to be manufactured in America by a new and wholly American process, as announced by E. I. du Pont de Nemours and Company. Two years of intensive research were required for the development of the new process, but officials of the company are now satisfied that it is commercially practicable, and a plant for large-quantity production has been constructed at Belle, near Charleston, W. Va., by a company affiliated with the du Pont interests. Future construction already planned is expected to take care of the entire American demand for methanol. The process involves the use of carbon monoxid and hydrogen at high temperature and under great pressure.

REDWOOD trees, imported from California and planted in the Gray's Harbor district of western Washington fourteen years ago by one of the large logging concerns of the Pacific Northwest, have proved a pronounced success. As a result, plans are under way to transform large areas of cut-over lands in the Gray's Harbor section into redwood forests. In the fourteen years a redwood tree has attained a diameter of eighteen inches, showing more rapid growth than that of any other variety of tree planted at the same time. The tree also shows every indication of being high-grade lumber stock. Other varieties planted included spruce, fir, pine and red and white oak. Encouraged by these results, the company is undertaking the growing of the redwood trees from seed, and in addition has planted more than 1,000 acres with spruce, fir and pine seed.

HONEY bees are killed by minute quantities of arsenic as used in sprays for fruit trees, and arsenical sprays should not be used while trees and plants are in full bloom, according to Dr. N. E. McIndoo and G. S. Demuth, of the U. S. Department of Agriculture. Such sprays should be used only after ninety per cent. of the blossoms have fallen from the trees, when the poisons are still efficacious and the majority of bees have abandoned the blossoms. Aside from the value of the honey crop they produce, bees are of considerable value in transferring pollens and thus effecting fertilization, and should be protected by horticulturists. The conclusions are the result of several years' study undertaken because of general agitation on the subject.

THE effects of various oils and other paint materials on ultra-violet rays, which have recently attracted much attention because of their newly discovered importance in medicine, have been the subject of study by George F. A. Stutz, of Washington, who spoke before the annual meeting of the American Chemical Society at Richmond, Va. The degree to which the rays are absorbed by linseed oil, the old standard paint vehicle, seems to depend in part on what has been done with it beforehand. Boiled oil absorbs the radiation entirely at the surface, whereas raw oil permits it to penetrate a considerable distance before it is completely extinguished. Oil dried by exposure to ultra-violet light is more opaque to the light afterward than is oil dried in diffuse daylight. Lacquer films, it was found, permitted a considerable penetration of the rays.

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SCIENCE NEWS

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THE ECLIPSE OF JUNE 29

PARTIAL success of the observations of the total eclipse of the sun of June 29 in England and the failure of expeditions to Norway because of clouds have again proved the fallibility of advance weather prospects. The English chances of clear weather were estimated months ago as only one in three, while in Norway they were said to be even. Yet the eclipse was seen in England, partly through light clouds, while in Norway thick clouds completely obscured the view. Dr. S. A. Mitchell, director of the McCormick-Chaloner expedition to Norway, the only scientific party from the United States, was unable to make any observations. This was his seventh eclipse, yet the magic number failed to bring him luck.

Dr. L. J. Comrie, of the British Nautical Almanac Office, who made the official advance calculations of the path of the eclipse over Britain, was at Southport, near Liverpool. He reports that the eclipse was seen from there through thin clouds, which concealed the faint outer extensions of the corona that were so noticeable at the eclipse of January, 1925, visible in New York. The corona is the outermost part of the sun, consisting at least partly of fine "dust" particles, and can only be seen at the time of a total eclipse. However, the bright inner corona, and the ring of the chromosphere, the sun's outer layer or "atmosphere," could be seen behind the black disc of the moon. A large prominence, or red flame of hydrogen, was observed from the upper part of the sun.

With Dr. Comrie was Dr. D. W. Morehouse, president of Drake University, at Des Moines, Iowa. Dr. Morehouse is a prominent American astronomer, and is known as the discoverer of Morehouse's comet. Dr. Caroline Furness, professor of astronomy at Vassar College, was also at Southport.

Gerald Merton, British astronomer and former war aviator, observed the eclipse from his own airplane, and succeeded in rising above two layers of clouds, at 4,000 and 9,000 feet altitude. He flew at 10,000 feet and while another layer of clouds was 5,000 feet above him, he had a fair view of the phenomenon. He also observed the shadow of the moon creeping across the clouds beneath him.

At Giggleswick, where Sir Frank Dyson, astronomer royal, set up his instruments, a rift in the clouds appeared opportunely a few minutes before the total eclipse commenced. It was observed with a clear sky from that point. Even this was not as narrow an escape as that of a party from the Lick Observatory to Goldendale, Washington, to observe the eclipse in June, 1918. Then a small rift appeared in the clouds at precisely the proper place a minute before totality, and closed a few seconds afterwards. It could hardly have been better timed to suit the astronomer.

AERONAUTIC LABORATORY OF THE CALIFORNIA INSTITUTE

IF it isn't handy to do scientific experiments on an airplane rushing through the air at 100 miles per hour, then rush the air 100 miles per hour past the stationary plane. Such in brief is one plan of the new aeronautical department of the California Institute of Technology. Thanks to the munificence of the Guggenheim Foundation, its elaborate aeronautic laboratory, now rapidly approaching completion, promises to aid in bringing aeronautic design into the domain of exact science.

The new plant includes a large wind-tunnel, wide enough to admit a small airplane. Powerful motor-driven blowers deliver a blast of air into one end of the tunnel, and withdraw the same air from the opposite end. The blast thus makes a continuous circuit within the building like a well-regulated tornado. The airplane, however, as far as the experimenters are concerned is traveling at high speed—admitting that motion is purely a relative matter.

In the wind-tunnel a variety of problems on shape, size and thickness of planes, wings, rudders, etc., will be tested, both in the interest of stability as well as lifting power and speed. Preliminary calculations on the form and directions of curved lines and surfaces are running into the most abstruse mathematics, some of which lead to conclusions not readily tested in common flying practice. Whence comes the aid of the laboratory.

In the earlier days of aircraft it was thought that the frontal exposed parts of an airship should be sharp or slim tapered. A pointed prow, fine piano-wire supports and extra-thin planes were favored. Actual practice on the contrary has shown that a properly-shaped strut of considerable width may actually offer less resistance to the air than a knife-edge or a wire. Apparently the old-fashioned billy-owl is not so badly designed after all.

The new air laboratory of the institute will include equipment for motor research and general engineering design, and will enjoy the cooperation of some of the best builders of mail and passenger planes now in service. Both American and German experts will direct research operations.

THE EARTH COMPASS

THE flight from California to the Hawaiian Islands involves a most difficult piece of navigation.

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In the Pacific Ocean it is different. The aviator has to fly for nearly 2,400 miles and hit a line of islands only 317 miles long. If he goes a bit too far north or south, he will not merely reach another part of the coast. Instead he will miss the islands entirely, perhaps without knowing it, and fly on until his gas is exhausted. And by that time he may be far away from steamer lanes.

But the same instrument that guided Lindbergh to the Irish coast, entirely by dead reckoning and without a single observation of a celestial or terrestrial guidepost, helps the Pacific fliers. This is the earth inductor compass, the product of genius in the U. S. Bureau of Standards. It was also the chief navigational instrument of Commander Byrd's *America*.

Like the familiar magnetic compass, the earth inductor compass depends on the fact that the earth is a great magnet. It also depends upon the principle of the electric dynamo. Spinning a coil of wire in a magnetic field produces a current of electricity in the coil.

In the dynamo, there is what is called a field magnet to produce the magnetic field which surrounds the moving coils, or armature. In the earth inductor compass, the earth itself acts as the field magnet. The armature consists of four coils of wire, wound to form a cross. It is spun as the plane goes through the air by means of a four-cupped windmill.

As the coils revolve they touch brushes which pick up the current generated. When the coils touch the brushes while they are in an east and west direction, there is no current. The wires of the coil are then moving in the direction of the lines of force of the earth. In order to have a current, the wires must cross the lines of force. However, if the soils are north and south, or in any other direction than east and west, a current does flow. Then a delicate galvanometer on the plane's instrument board shows the deviation from the course.

To use the compass, the brushes may be set so that they are in an east and west direction, when the plane is flying north, for example. The galvanometer will tell the pilot if he departs from a northerly direction. If he wants to fly in another direction, the pilot can set a controller dial. Then the galvanometer will indicate zero when he is flying in the direction for which the control dial has been set. If he starts in the wrong direction, he merely has to turn the plane slightly, and the galvanometer needle will again indicate zero.

The chief advantage of the earth inductor over the old form of compass is that it can be read at a distance. The inductor mechanism is set in the tail of the machine, far from the electrical coils and steel of the engine and other machinery that would affect the compass needle. Also, the motion of the plane as it banks on one side or the other does not disturb it, as it would a freely swinging needle.

The sun compass which Commander Byrd used on his polar flight is especially adapted for use in the Arctic, because there the magnetic pole is south of the flyer. A magnetic compass, whether earth inductor or not, would indicate any direction but north. Every Boy Scout is familiar with the principle of the sun compass, for he can use it to find the north with a watch.

Point the hour hand of your watch to the sun. Then south is half way between the hour hand and the figure twelve. If the watch were of a kind used in European countries, with a twenty-four hour dial, it would be simpler. Then you would merely need to point the hour hand to the sun, and the figure twenty-four would point to the south. In effect, the sun compass is such a twenty-four hour watch.

CELLULOSE FILMS

CELLULOSE, the principal constituent of wood fiber, may revolutionize photographic methods by its use in photographic films. A new process has just been developed by Philippe David, collaborator of A. Bertillon, the famous criminologist, by means of which it takes the place of gelatin as a support for the sensitive silver salts.

In the ordinary photographic plate of film the base of glass or celluloid is coated with a layer of gelatin in which are suspended the silver bromide particles. The gelatin layer is rather delicate, and great care must be taken with the films or plates before they are dry. Too much heat will melt the coating and spoil the picture.

With the new films gelatin and its disadvantages are eliminated. As the cellulose does not dissolve even in boiling water, the developing chemicals may be used hot to speed up the process. They may be developed in 3 to 4 minutes, fixed in 2 minutes and washed in 30 seconds, instead of the 15 to 30 minutes that the latter process now takes. Then they can be dried over a flame or in a hot oven in 2 or 3 minutes. The entire process, from the start of development to the dry negative ready for printing, is over in ten minutes at the most. This is a far shorter period than can be obtained at present, and it is anticipated that the new films and plates will prove especially valuable, both for still and motion pictures, in portraying news events.

THE FLAX WILT FUNGUS

HAS the parasitic fungus that causes the destructive wilt disease of flax been evolving under our very noses, to meet the handicap imposed by the breeding of resistant strains of its host plant? Or have the special fungus strains been in existence all along, only to be sorted out and detected now that the new flax varieties have been established? These are the riddles now confronting plant pathology experts at the university farm of the University of Minnesota.

From about 1905 until a few years ago, flax wilt threatened to wipe out flax growing in many regions of the United States. Then resistant flax varieties came into wide use, and production increased again with considerable profit to northwestern farmers. But the disturbing fact has developed that resistant flax varieties have in some regions shown themselves more or less susceptible to the disease, and though part of this could be blamed on the weather and other outside factors, not all the trouble could be traced to these causes.

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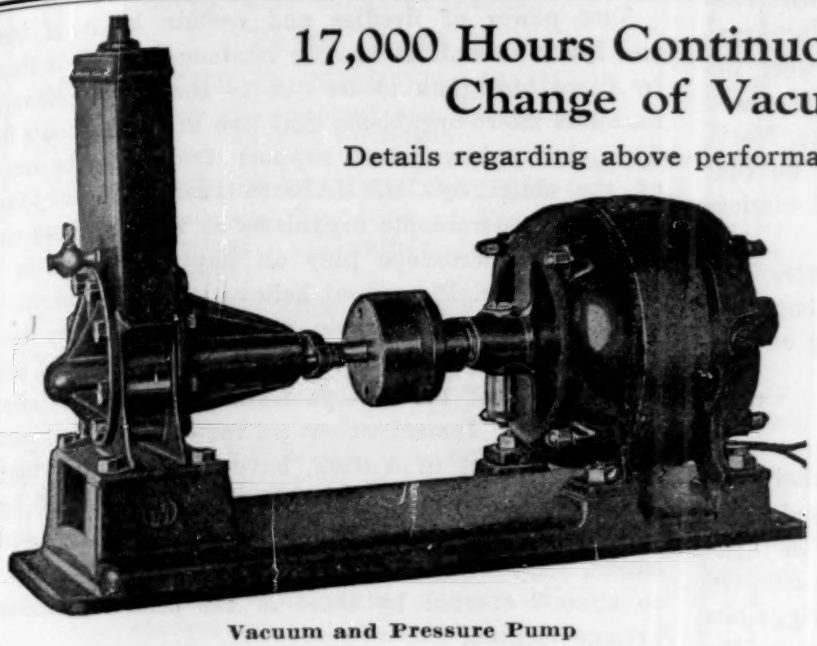

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Tests recently made by W. C. Broadfoot, of the Minnesota Experiment Station, show that the flax wilt fungus species is divided up into at least nine separate strains, or so-called physiologic forms. They were determined by the relative amount of injury they caused on four varieties of flax, collected from Minnesota, North Dakota, Saskatchewan and Manitoba. It may be that further examination of other flax varieties will disclose still other physiologic forms of the parasite.

This discovery very considerably complicates the problem of developing flax varieties that will completely defy the disease, and may require the breeding of special strains for cultivation in each region.

MEDICAL EXPERTS

DUELS between psychiatrists disputing the sanity of a prisoner in court will be ended if recommendations by the American Psychiatric Association result in legislation through the country. The association has adopted a report advocating state laws similar to the Briggs law of Massachusetts "which puts the psychiatrist in the position of counselling the legal authorities as to the disposal of social offenders."

The Briggs law, used as a model, provides that if an individual is indicted for a capital offense or if he is indicted a second time for a felony, he is examined by the State's Department of Mental Diseases, which delegates two psychiatrists appointed by the state. If the prisoner is found insane, he is generally committed to a state hospital for mental diseases or for the criminal insane without the delay and expense of a court trial.

This law, which has been in effect in Massachusetts for six years, was formulated through the efforts of Dr. L. Vernon Briggs, the well known psychiatrist.

"Before the law was passed in Massachusetts," said Dr. Briggs in an interview, "there was scarcely a day when psychiatrists, often graduates of the same university, were not pitted against one another, some employed by the prosecution and others by the defense. And this condition still obtains in the other states. In border line cases of mental disease a partisan expert can persuade himself that one side or the other is right. But this has brought disrepute to the profession, and experts have been considered unscientific, willing to sell themselves to either side. Furthermore, when testimony is presented on each side by equally able men, a jury is at a loss which to believe, and as a result they may throw out the expert testimony which should have been useful in guiding them."

Legislation similar to the Briggs law is now being considered for adoption in Belgium and Great Britain, and by New York.

The objection sometimes heard, that if psychiatrists regularly examined prisoners they would find them all psychotic, or mentally defective, or psychopathic, is not borne out by the records of Massachusetts since the law has been in effect.

Dr. Winfred Overholser, director of the division for examination of prisoners, states that out of 295 persons examined, only 21 per cent. were diagnosed as definitely abnormal in mentality.

ITEMS

THE power of fireflies and certain kinds of insects and lower animals to become luminous at will is thought by some biologists to be due to the action of various harmless micro-organisms that live in the animal's body. This theory has recent support from reports received of the claim by Dr. Umberto Pierantoni, of Naples, that ultra-microscopic organisms as well as those visible under the microscope play an important part in such reactions. Dr. Pierantoni believes that the introduction of these ultra-microscopic organisms into the egg of an insect will cause a change in the direction of the development of the embryo leading to the formation of new organs. Investigations on luminous insects, according to a report in *Nature*, have demonstrated that the presence of such micro-organisms is accompanied by the appearance of highly complicated structures such as lenses, reflectors, refractors and analyzers of light, due to stimuli exerted by them in the cells in which they become located.

THE report that a mysterious totem pole carved with a human figure is floating down the flooded Skeena River has been received by Harlan I. Smith, the Canadian government archeologist. Mr. Smith, who is engaged in preserving ancient totem poles and making out-of-door museums of them, has checked up on his collections and finds no exhibits in this region missing. A call was issued immediately to all persons along the Skeena River below Vanarsdol to look out for the traveling pole and if possible to rescue it and notify Mr. Smith. Federal authorities now protect Indian monuments, Mr. Smith points out, so that it is unlawful to take such an object without permission, or to mutilate or destroy it.

THE forests that grew in the widely separated swamps of what are now the states of Rhode Island and Missouri were strikingly alike in the plants that composed them, according to Dr. Eda M. Round, writing in the forthcoming number of *The Botanical Gazette*. Dr. Round has made a close comparison of fossil plant remains from the sandstones and shales of these regions, and states that over 50 per cent. of the plant species of the two localities were identical. None of the species that grew there those many millions of years ago survives into the present time, but the nearest relatives of some of them are now represented by ferns, club-mosses and scouring-rushes or horsetails.

The Berlin Society for Race Hygiene, according to the Berlin correspondent of the American Medical Association, has offered a prize for the best scenario of a eugenical movie. The film story must give a clear idea of the important principles of heredity in man but must exclude all forms of religious and political propaganda. The German society especially desires that measures of eugenics that will tend to preserve valuable physical and mental qualities should be pointed out and the dangers of degeneration duly stressed.

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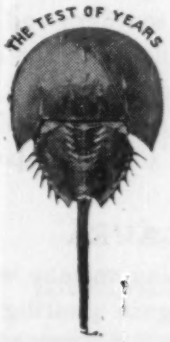

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SCIENCE NEWS

Science Service, Washington, D. C.

CLAY LAYERS IN NEW JERSEY AND THE ICE SHEET

In the Hackensack meadows of New Jersey there has been found a natural calendar record of the retreat of the last great ice sheet that covered America not less than 20,000 years ago. The clays that form the meadows tell a graphic story of the northward retreat of the ice.

Dr. Chester A. Reeds, of the American Museum of Natural History, will head an expedition to these meadows this summer to complete his study of the clays. For the last few years he has been collecting glacial clays from the Hackensack Valley and other points along the Hudson. He has analyzed and tabulated his findings to date. These findings plus the results of this summer's expedition will present in compressed form the geological history of this part of the country at the close of the last ice age.

The clay deposits tell their tale in this manner: With the gradual retreat of the ice fresh-water lakes formed in the lower portions of the enclosed basins in front of the glaciers. During the warm summer months of each year the ice melted and retreated a little to the north. With the melting process swollen rivers which flowed out from under the ice mass picked up fine sand and clay particles and carried them down to the lakes. These particles collected in the still waters of the lakes. The heavier particles of fine sand and coarse clay settled on the lake bottoms to form the sandy summer layer. The finer clay particles were held in suspension in the milky water throughout the summer. But with the coming of winter even the fine particles sank and covered the lake beds with a dark deposit of pure clay. By the next summer the water was clear again and the process repeated itself. Thus a sharp line has been drawn between summer and winter deposits. The summer deposits are sandy and light in color; the winter deposits, pure, dark clay.

By excavating the clay just as it stands and by the tedious process of counting the light and dark layers Dr. Reeds is able to trace the northward movement of the ice. Two deposits, a light summer layer and a dark winter one, equal a year. Dr. Reeds has already found in a forty-five-foot depth of clay a continuous series of layers representing 2,550 years for the deposition of material as the ice-front moved slowly northward up the Hackensack Valley. Deeper deposits are found to the south than to the north which shows that when the glacier still covered the northern part of the valley the southern end was gradually loosening from the grip of the ice. By comparing deposits throughout the length of the valley Dr. Reeds can trace the movement of the glacier through the years and the history of the return of a temperate climate.

THE ERUPTION OF KILAUEA

The awakening of Kilauea, the Hawaiian volcano which after three years' quiescence is now again pouring out lava, is considered by volcanologists to be the first stage of a lengthy period during which the inner crater, Halemaumau, will gradually fill with the molten rock.

Experts do not look for a repetition of the great explosive eruption of 1924 when the crater of the inner "Pit of Everlasting Fire" was enlarged ten times. Another sort of eruption is now in progress.

Kilauea is one of the five great volcanoes which have joined in forming the Island of Hawaii. Besides Kilauea, Mauna Loa and Hualalai have been active in historic times. Kilauea consists of a low dome 4,040 feet high on the southeast side of the great dome of Mauna Loa, three times as high. On Kilauea's summit is a shallow crater, three miles long and two miles wide, and in the floor of the crater is the pit of Halemaumau, a hole about 3,500 feet across extending about 1,300 feet below the rim of the volcano. It is within this great fire pit that the lava has now reappeared.

It is estimated that there is now about 50 feet of lava in the inner pit and that it will take about a year for this great hole to fill. When filled, the lava will flow out upon the floor of the main crater.

Upon the very rim of this crater now showing renewed activity there is an observatory from which scientists keep constant watch upon the sleeping volcano. This unique institution is under the direction of Dr. Thomas A. Jaggar, who at present is in Alaska investigating volcanoes there and planning similar observatories for that territory. In his absence R. M. Wilson is in charge. Each week for the past few years a letter reporting Kilauea's condition has been issued to the scientists of the world.

Kilauea's present activity is being watched with interest by two Washington scientific organizations, the U. S. Geological Survey, under whose jurisdiction the Hawaiian Volcano Observatory falls, and the Geophysical Laboratory of the Carnegie Institution of Washington, which has conducted investigations of volcanic explosions throughout the world.

Dr. Arthur L. Day, director of the Geophysical Laboratory, has made personal investigations at Kilauea and is waiting further reports of the eruption, with interest, before determining whether further research will be undertaken.

In less scientific days there would be wide-spread attempts at the appeasement of the anger of Pele, the dreaded goddess of Kilauea. Even to-day native Hawaiians are reported to have made offerings to the volcano.

While much must still be learned about volcanoes, science now knows that they are local affairs, comparatively small test tubes for cosmic chemistry, and not outlets for a vast interior mass of liquid fire deep within the earth. It has also been discovered that the boiling lava is hotter at the top than it is in its depth.

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INVESTIGATIONS OF INFLUENZA IN ENGLAND

THE recent influenza epidemic in England has been studied in the research laboratories. Scientists, frequently afflicted themselves, seized the opportunity to collect valuable information and took cultures from the noses and throats of each other, their assistants and their own families as they fell victims to the advance of the epidemic, in the hope of isolating the causative germ of the baffling disease.

Dr. G. S. Wilson, bacteriologist at the University of Manchester, attempted to isolate a bacterium that workers at the Rockefeller Institute for Medical Research in New York believe may be responsible for influenza. Cultures taken within 24 hours after a typical attack from patients who were on the laboratory staff failed, however, to yield up the suspected germ. Since the technique of the original investigators was carefully followed this may be taken to indicate that this particular organism is not the answer to the great influenza hunt that engages the attention of medicine at the present time.

Drs. David and Robert Thomson, of the research laboratory of St. Paul's Hospital, were able to get a blood culture within eight hours after one of them contracted a severe attack. The disease is so frequently complicated by secondary infections that the search for the causative organism of influenza itself involves prompt action as soon as possible after its presence is definitely ascertained.

The St. Paul research men were no more successful than the others in their search for the bacterium of the Rockefeller workers. They did isolate from the blood culture, however, a characteristic streptococcus, the type of bacterium that grows in bead-like chains, that they were able to find in several other patients. When the original influenza victim had a subsequent mild attack the streptococcus was located in cultures taken from the mouth. They do not claim that this is actually the long-sought-for organism, but they do point out that it will bear looking into by other research workers engaged in this vital problem.

INDIAN MOUND OF OHIO

A LARGE Indian mound near Bainbridge, Ohio, is being sliced like a loaf of bread by exploring archeologists who have found thirty Indian burials and a complicated internal structure.

What appears to be an elongate earthen pyramid is buried under the external surface of the so-called Seip mound. Seen from the outside the mound looked merely like a great rounded heap of earth, 240 feet long, 150 feet wide and 30 feet high.

The basis of the mound is a lower mound, shorter and narrower than the covering structure, rounded on top and covered with a layer of gravel. Presumably this lower mound was for ceremonial purposes for under it are found the Indian burials. Covering this inner mound is a mass of earth with steeply sloping sides, like the roof of a house or a long pyramid, and over this in turn there is another mass of earth, noticeably different from the "pyramid" in color and texture, which gives the outer mound its final rounded shape. Over this again is a layer of river gravel, thin at the top and thicker at the sides and held in place at the bottom by a wall of large stone slabs. All this great hill of earth was toilsomely built many centuries ago, by Indians whose only way of carrying it was in baskets on their backs or heads.

The peculiar and puzzling structure of this mound has been disclosed only by the methodical system pursued in opening it. The work is being done under the direction of Dr. H. C. Shetrone, of the Ohio State Archeological and Historical Society. He has a gang of workmen and dirt-handling machinery at his disposal, in addition to a group of research students to do the more exact work. Every cubic foot of earth in the mound is being moved. He is cutting off the mound slice by slice, examining everything he finds as he goes. Before snow flies he expects to cut his last slice. Then he will put the mound back into as nearly its original form as practicable.

To date, he has sliced off a little more than half the mound, and has uncovered about thirty Indian burials. Almost all of them are just above ground level, under the inner mound. A few are three or four feet higher. These latter were important chiefs, judging by the burial gifts found with them, which included great strings of river-mussel pearls in addition to the usual stone, bone and pottery offerings, and ornaments and weapons of copper.

WOOD PRESERVATION

PRESERVATIVES against decay are injected into wooden poles with an apparatus like a hypodermic needle on a huge scale, by a recently patented German process. Rows of holes are made all around the pole in the zone exposed to rotting, and appropriate chemicals in paste form forced into them through hollow tubes. The preservatives then spread along the grain of the wood, the area around each injection overlapping that around its neighbors and forming a complete protective sheath.

The inventor claims several advantages for his process. Inasmuch as the apparatus is compact and easily portable, poles can be treated where they are to be set, instead of having to be assembled at permanently located treating tanks and then shipped out again. One or two men can do all the work, instead of the larger gangs now needed. Untreated posts already erected can be treated without pulling them up and resetting them.

A saving in material is also claimed. The creosoting processes now used treat either the whole pole, or at least the whole underground part of it, to the same depth. This is said to be unnecessary, because the maximum decay takes place at the ground level and for a couple of feet below it, the butt of the pole being usually little more rotted than the top. By the new process, it is possible to give the rapidly-decaying zone a heavy dose of the preservative, and then give the rest of the pole a lighter treatment.

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against a new signal device invisible from the outside yet capable of calling a squad of armed guards upon him as he works, which has been devised by the engineers of the Bell Telephone Laboratories. In fact, the safe-blower now works under war-time conditions, for the new alarm is founded on the Type H inertia microphone developed in the laboratories during the war for submarine detection.

This alarm consists of a microphone capable of detecting the most minute vibrations of the walls of a safe. It has already been installed in several banks in New York City and in Philadelphia. The microphone will not pick up sound waves. The stimulus is received mechanically rather than acoustically. But the slightest jar will be sufficient to set in motion an electric current to the main office where both audible and visible signals will be received.

Such devices have been conceived before. But heretofore they have transmitted vibrations and even sounds from outside. Thus guards have been summoned when merely a heavy truck was rumbling by or when street conversations grew sufficiently loud.

The newly developed microphone, however, is not affected by disturbances outside the vault. At one of the banks in which it is installed subway trains rumble constantly within a few feet of the vault and no false alarm is sent out. But let a careless cleaner so much as knock the handle of his broom against the vault door or walls and armed guards will come to investigate. As for cracksmen, even the acetylene torch is without avail. It causes a sputtering of the molten metal strong enough to shake the wall slightly.

Further, the microphone takes up infinitely less space than the wire signal system. It is small and several microphones effectively placed will be sufficient to protect the largest room. In contrast to this compactness, eighteen miles of wire were recently used in installing the old alarm system in the vault of a prominent New York bank.

ITEMS

BARLEY has been grown by the human race longer than wheat, so far as evidence now in hand indicates. In the *Journal of Heredity*, Dr. O. F. Cook, of the U. S. Department of Agriculture, discusses the researches of an English scientist, Professor G. Elliott Smith, who has been examining the remains of grains found associated with the mummies of the most ancient times in Egypt—frequently inside them. In these oldest mummies, the grain is always barley, never wheat, whence the conclusion is drawn that the Egyptians knew barley long before they cultivated the latter grain.

RADIO waves will never make two blades of barley grow where one grew before, according to plant physiologists of the U. S. Department of Agriculture, in reply to statements ascribed in a recent news item to Admiral W. H. G. Bullard, chairman of the Federal Radio Commission. Admiral Bullard was quoted as saying that barley planted under the radio towers at Arlington grew so high that it overtopped men walking through it, due to the influence of the radio waves. Many researches have been conducted in electriculture to determine this very point and the results have always been either inconclusive or distinctly negative. The Arlington barley, it is pointed out, had no "control." That is, there was no other plot of barley planted on exactly similar soil but removed from the possible influence of the waves. Without such "controls" no biological experiment has any value whatever. In the experiments of the plant physiologists there were always "control" plants, which showed little or no difference from the ones exposed to the electrical waves.

MANGANESE deficiency, a disease afflicting plants that grow in certain types of soils, can be cured by hypodermic injections with a solution of this necessary mineral, as well as by the more usual method of supplying fertilizers containing it. Dr. Forman T. McLean, of the Rhode Island Agricultural Experiment Station, recently told a Science Service representative of his experiments. He raised a number of plants on soil with all the natural manganese removed, and when they began to show the characteristic symptoms of manganese starvation he injected into their leaves a very weak solution of a salt containing it. The sick plants very promptly recovered.

A NEW method of making airplanes safe for passenger traffic has been devised by a German inventor, Dr. Roland Eisenlohr. It is an improvement on an American plan to attach a large parachute to the entire airplane, with provision for opening it in case of accident, and letting the whole machine gently down to earth. Because of the large amount of dead weight, in engine, fuel tanks, wings, etc., the American invention requires a relatively enormous parachute. To eliminate as much of this as possible, Dr. Eisenlohr proposes to place passengers and pilots in a separable cabin, to which the parachute will be attached. Then, in case of accident, the mechanical parts of the plane are permitted to fall away, while only the cabin makes the slower, safe descent. This scheme would be of especial value in case of fire, for it would instantly get rid of the flaming fuel tanks.

EXPERIMENTS will soon be made in England on the velocity of sound when firing of big guns will be broadcast by radio from the artillery proving grounds at Shoeburyness. People for miles around will have the opportunity of hearing the guns by radio, and then, several minutes later, of hearing the actual sounds as they travel through the air. This announcement is made by Dr. F. J. W. Whipple, of the Kew Observatory, in *Nature*. He says that at Grantham, about 80 miles from Shoeburyness, he has heard the firing of the guns between 10¾ and 11¼ minutes after they were discharged. Such abnormal distances for sound seem to be the result of an effect something like that of the Heaviside layer which reflects radio waves down to earth again instead of letting them go out into space. Dr. Whipple says that it is agreed that such long range sound records are the result of a layer of the air some 25 miles or more above the earth's surface, where the temperature is relatively high, and the sound waves are refracted down to earth again. Thus a sound that might be inaudible at 20 miles' distance might be heard at a hundred.

THE SCIENTIFIC MONTHLY

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SCIENCE NEWS

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THE EFFECT OF LIGHT AND HEAT ON PLANT GROWTH

SPRING wheat harvested 35 days after sowing, red clover in flower 38 days after seeding, a large head of lettuce grown in three weeks. These are the remarkable results obtained through the use of artificial light, heat and atmosphere at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y.

Three things are responsible for this speeding up of plant growth, Dr. John M. Arthur explains in a report to the Engineering Foundation. One is bright illumination, in some cases for 24 hours a day. Another is high temperature. The third is increased amounts of carbon dioxide in the atmosphere.

The researches were made in an effort to find out how plant processes may be made more efficient. Photosynthesis, the method by which light causes substances to combine, makes plant growth possible. In nature it is a very inefficient operation. Only about one per cent. of the energy that falls on the plant is utilized.

"An unusual opportunity for the efficiency expert!" Dr. Arthur says. "If only a few tenths of one per cent. could be added to the efficiency of photosynthesis, an enormous increase would be available in total energy fixed when applied to nature's vast quantity production. Over one hundred years ago, de Saussure showed that green plants not only use the small amount of carbon dioxide normally in air, but can use more when available. These facts indicate a means of increasing the efficiency, yet no application was made until the recent world war. Then, under pressure of food shortage in Germany, processes were perfected by Riedel and others for scrubbing gases from combustion of coal, coke and charcoal to produce carbon dioxide. The gas was piped into greenhouses among growing plants. With high temperature and high light intensity a concentration of less than half of one per cent. of carbon dioxide will about double the dry weight of plant tissue produced."

Many plants can use more light than they get from nature. If such plants are kept continually under an arc light, or if artificial light is used to supplement daylight, their growth is hastened. Wheat and clover will stand full 24 hours of light a day. The tomato, however, needs a rest, and it grows fastest with 12 hours of daylight and 6 more of artificial light.

Commercial application of these facts is not yet in sight, Dr. Arthur points out. Every day 1,500 kilowatt hours of electricity were used during the plant tests. The ordinary home seldom uses more than one kilowatt hour a day. From researches like these may come in time new means for producing some foods and fuels and other supplies for human needs. Economic achievement, however, yet appears remote except in small scale operations.

DRAINAGE FOR TREE GROWTH

DRAINAGE for agricultural purposes has been carried to the point of being too much of a good thing in the mid-northwestern states, but conducted on a more moderate scale for forestry purposes would be a very good thing, in the opinion of Rafael Zon, director of the Lake States Forest Experiment Station at Madison, Wis. Bone-dry drainage of bogs, swamps and small lakes has run ahead of the market demand for farm lands in the region and has put taxes up to a point most unpopular with the farmers, besides exposing the tinder-like peat to summer drought and hence giving rise to an abnormal fire risk.

But partial drainage of the wet timber lands, based on practical experience already obtained in Europe in the lands around the Baltic Sea, he thinks, would be a most profitable thing for both private and public forestry in America.

The typical timber swamp in the Lake States region has a zone of deep peat around its edge, which thins out gradually until it gives place to the sandy or loamy upland. There is a regular succession of trees from the water's edge outward, beginning with tamarack, and running through black spruce, cedar, balsam, black ash, red maple, white pine, birches and poplar to upland hardwoods, by blending stages. In general, the wetter the soil the more stunted and useless for lumber are the trees. This is partly because the water is acid, partly because it contains little or no oxygen for the roots to breathe, and partly because it hinders the normal bacterial population which would develop greater fertility in the soil.

Lowering the water table, or permanent level of soil water, remedies these and other unfavorable conditions and gives the trees a new lease of life. In one case cited by Mr. Zon, seven years after partial drainage, runty trees ten feet high and a little over a foot in trunk diameter had doubled their height and more than doubled their thickness. And experience in Europe, he says, has definitely shown that judicious partial drainage pays in dollars and cents.

ALASKAN EARTHQUAKES

EARTH movements around Alaska will soon be as extensively studied as those in other regions around the Pacific Ocean as a result of a series of investigations to be undertaken by Dr. T. A. Jaggar, chief volcanologist of the U. S. Geological Survey, who usually makes his headquarters in Honolulu. Now he is at Kodiak, Alaska, where he is installing a seismograph and other scientific instruments for the recording of movements such as earthquakes and earth tremors. The United States naval radio station at this point will communicate all records on the instruments to the other United States stations, as well as to other parts of the world.

The department in Dr. Jaggar's charge already includes the station at Kilauea volcano, Hawaii, and Mt.

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Lassen, California. The work of these areas is closely coordinated and is very valuable for scientific study.

Instruments for the station at Kodiak have been constructed at the observatory here, and are to be shipped to Dr. Jaggar in a few days. They include a modern seismograph for recording earth movements, as well as other apparatus.

The Alaskan installations, it is said, will supply information that is very much needed, as there have previously been few accurate records for the area of the Northern Pacific. There are already numerous stations in Japan, Hawaii and California, so that in conjunction with these the Northern Pacific will be well provided for.

The region of southwestern Alaska and the Aleutian Islands is declared by Dr. Jaggar to be one of the most active volcanic areas in the world. It is entirely possible that earthquakes originate here that are felt in other parts of the world. The extension of scientific earthquake studies to this part of the world is expected to add much to knowledge of volcanoes and the earthquake phenomena associated with it.

R. M. Wilson has been placed in charge of the observation station here during the absence of Dr. Jaggar, and Roy Finch is in charge of the station at Mt. Lassen, California.

Following the completion of the installation work at Kodiak Dr. Jaggar plans to go to Unalaska, where he will make observations and later will install recording instruments. Cooperation not only of the government agencies in Alaska but of individuals and firms has been promised Dr. Jaggar in his work, since it is felt that his observations will be of benefit and interest to all who have contacts in this region.

BIRD LIFE OF THE SOUTH SEA ISLANDS

If you want an object lesson in the active process of evolution take a look at the reed warblers of Polynesia.

This is the advice of Dr. Robert Cushman Murphy, of the American Museum of Natural History, who this summer is compiling data on the Whitney South Sea expedition. This expedition for the last seven years has been making a detailed study of the little known bird life of the South Seas. It is financed by Harry Payne Whitney. Much of the time Dr. Murphy has been in the field. But this summer he is working on specimens brought to the museum while Rollo H. Beck heads the activities in the Pacific.

Regarding the reed warblers, Dr. Murphy holds that they are a vivid illustration of the working of evolution. The Polynesian Islands consist of countless spots of land dotting the southern Pacific. On each island reed warblers will be found. They are small birds related to the reed warblers of Europe. But the Polynesian birds are remarkable because on each assemblage of islands a distinct variation of the same genus has developed. These variations seem almost individual races, Dr. Murphy says, so do they differ from each other in size, proportion and color. They run all the way from large yellowish types in the Society Islands and the Marquesas to a very small, gray warbler on Christmas Island. Yet they all show unmistakable evidence of being the same species fundamentally.

These variations are a graphic example of the working forces of evolution. The birds, Dr. Murphy says, are of sedentary disposition. They do not roam, but stay on their particular islands where their needs are filled. Thus each group is entirely separated from its neighbors and has been free to develop along its own lines. The tendencies of each group's ancestors were unhampered and isolated and in due course they produced the widely divergent forms of the same original species which startle visitors to Polynesia.

MEDICAL EXAMINATION OF EGYPTIAN MUMMIES

Few if any of the ancient Egyptians suffered from syphilis, members of the hoi polloi had far better teeth than the ruling classes and Pharaoh Siptah of the nineteenth dynasty had a club foot. Such are some of the health facts about life in the valley of the Nile from three to six thousand years ago gleaned by recent research undertaken by Dr. Arnold Sach, of Heidelberg University.

Dr. Sach has just completed a detailed pathological examination of over 30,000 mummies in the hope of gaining some insight into the health conditions among the ancient Egyptians, a point of great interest to modern medicine because the Egyptians were known to have a comparatively highly developed art of healing. Malformations and bone fractures were the obvious things that came to the attention first and in many cases the mummies were found to be still wearing artfully contrived splints. Bladder stones were found in mummies dating back to periods before the earliest dynasties, indicating that this affliction was present from very remote times. Stones in the kidney did not appear until 3,200 B. C.

Degenerating teeth are evidently one of the prices mankind has always had to pay for an advancing civilization. Bad teeth were rare during the early period of Egyptian history, and in the poorer population almost entirely lacking. The teeth of 500 mummified remains of Egyptians of the highest class, excavated near Gizeh, showed nearly as much tartar formation and dental caries as those of modern Europeans.

Dr. Sach's researches constitute an argument for the negative in the controversy over the presence of syphilis in the ancient world, for no changes indicative of this disease could be detected in any of the mummies examined. The only case of leprosy occurred in one dating from the late Christian era, which strengthens the assumption that has been made that the leprosy of Biblical times is not the disease that we know. It is now thought that the leprosy of antiquity is a malady different from that which goes under the name at the present time and that its exact nature can only be explained by further research in historical medicine.

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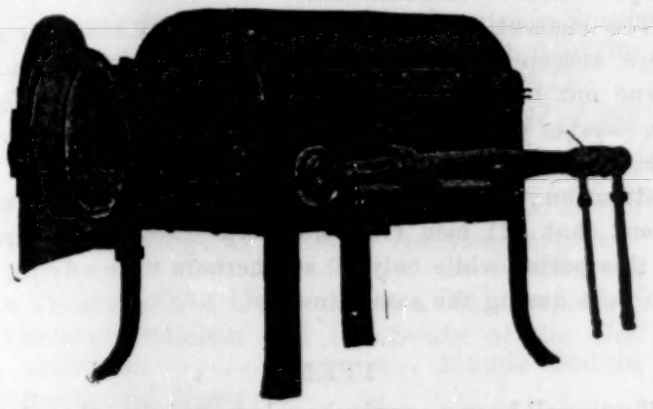

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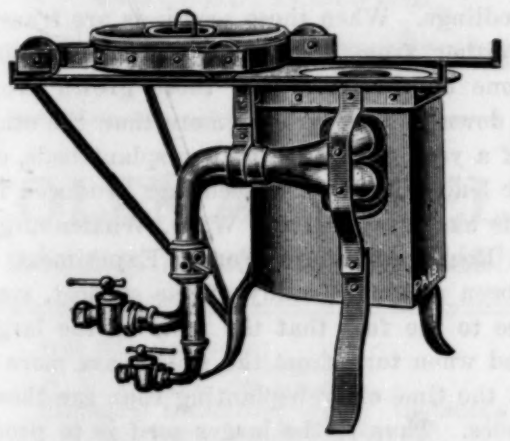

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LANCASTER, PENNSYLVANIA

How this has been brought about, largely by means of a special psychological test, is announced by Commander D. E. Cummings, U. S. N., in an account to appear in *The Personnel Journal.*

In 1923, the number of men who were unable to adapt themselves to Navy life had grown to excessive proportions. Almost one third of the separations from the Navy were desertions, and only 44.6 per cent. left the Navy by honorable discharge or transfer to the Fleet Reserve. Courts martial were at the rate of 18,000 a year, with an enlisted force of 86,000 men. Altogether, a serious situation.

To find out whether general intelligence has any connection with the ability of a man to make good in the Navy, the O'Rourke General Classification Test, prepared and standardized by Dr. L. J. O'Rourke, now director of research of the U. S. Civil Service Commission, was put into use.

Five hundred men who had deserted and been apprehended were first tested, and also 2,000 recruits. The scores of the deserters ranged consistently lower than those of the recruits in general. They showed that if men who made a score lower than 30 on the test were not allowed to enlist, 22 per cent. of the deserters would be eliminated, and only a comparatively small percentage of men who might make good would be excluded. Further applications of the test confirmed the relation between low scores on this particular test and the likelihood of delinquencies and failure in naval life.

It was also found that men who had gone farther in school were more likely to make good in the Navy than men who had poorer educations. This is not surprising, Commander Cummings points out, considering that enlisted men are called upon to perform highly technical work, such as aligning turret guns, figuring ballistic corrections, handling radio communications and materials, and innumerable other things requiring greater intelligence, initiative, responsibility and education than was required of sailors in former days.

Tests on recruits during the past year designed to show more definitely the relationship between delinquency and intelligence have not progressed very fast, owing to the fact that desertions and courts martial have decreased so greatly.

DANGERS OF SUNSTROKE

IT is time to keep on the safe and shady side of the street when the mercury begins to crawl up above ninety. Speech disturbances, hallucinations and paralysis are some of the things a victim of sunstroke may wake up to, if he recovers at all, according to Drs. E. G. Wakefield and W. W. Hall, of the U. S. Naval Medical Corps, who have recently completed a study of heat injuries. Even after these unpleasant manifestations have worn off and the patient has recovered he may remain hypersensitive to heat throughout his life.

Heat-stroke or sunstroke is one of the oldest known diseases according to medical authorities. Two cases are unmistakably described in the Bible, one in the fourth book of Kings and the other in the apocryphal book of Judith. Until the middle of the nineteenth century the effects of heat injuries were confounded with apoplexy. From the time of the publication in 1858 of the experimental work by the great French biologist, Claude Bernard, on the effect of heat, however, the theory of the disease has been based on experimental observation.

Drs. Wakefield and Hall are engaged in research on this vital problem of hot weather from which they hope to obtain results which will elucidate further just why people succumb to sunstroke.

The contention that people from cold countries are more susceptible than those from warmer regions is borne out by data obtained by the Navy doctors from the number of heat injuries sustained by enlisted men in the fiscal years 1924 to 1926. In a report of their investigation to the American Medical Association they assert that 121 men from northern states were afflicted in this period while only 89 southerners were affected by the heat during the same time.

ITEMS

THE well-known agricultural principle, that better plants grow from large seeds than from small, has been tested out in forestry with promising results, according to E. N. Munns, chief of the office of forest experiment stations of the U. S. Forest Service. In various tests with important western forest trees such as the California sugar pine, western yellow pine and the Douglas fir, it has been found that the largest seeds sown do produce the largest seedlings. When these seedlings are transplanted, however, either from one nursery bed to a more commodious one or to the forest, those grown from large seed slow down in their growth more than the others. At the end of a year or two in the transplant beds, or in the forest, the lead taken by the seedlings produced from the large seeds has disappeared. W. G. Whalenburg, of the Northern Rocky Mountain Forest Experiment Station, who has been making a study of the subject, states that this is due to the fact that the roots of the larger trees are injured when torn from the soil or are more severely pruned at the time of transplanting than are those of the smaller trees. Thus if the larger seed is to produce the larger tree it must be sown not in a nursery bed but in the forest where the tree is to grow permanently.

THOUSANDS of boys and girls on organized playgrounds in some 800 American cities are expected to compete this summer in a national model airplane construction and flying contest sponsored by a committee headed by Orville Wright, airplane pioneer. The recent achievements of aviation, particularly the Lindbergh flight, inspired this competition which will be conducted by the Playground and Recreation Association of America. It will come to a climax at national finals to be held in Memphis in October. The contest was suggested by Dr. John H. Finley, educator and editor, as a means of interesting the youth of America in the scientific principles underlying aviation. The three federal air secretaries, F. Trubee Davison, of the War Department; Edward P. Warner, of the Navy, and William C. McCracken, of the Commerce Department, have accepted membership on the contest committee.

THE MONIST

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SCIENCE NEWS

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RAINFALL IN CALIFORNIA

STUDY of weather conditions in interior Asia may help predict the rainfall in California several months in advance in the opinion of E. A. Beals, of Alameda, who has presented the results of his studies in a report to the American Meteorological Society.

"From a daily study of weather maps prepared under my supervision at Portland, San Francisco and Honolulu for a quarter of a century," says Mr. Beals, "I have come to the conclusion that the most hopeful solution of the problem of long range forecasting in California lies in getting more detailed information about the winter high-pressure center of action over Asia. Very little is known about this disturbance for the reason that the Chinese and Mongolians have not been interested in making weather observations along modern lines. The Russians have many meteorological stations in Siberia, but as our government does not recognize the Russian government, the recent data they have accumulated can not be officially procured by the United States Weather Bureau, though it can be obtained by private individuals by corresponding directly with the Russian weather observers.

"To California, the track the storm takes after leaving the Aleutian Islands on its way to the United States is vital. The full maturing of our crops can not take place without sufficient moisture, and much money and labor could be saved, or adequate preparations made, if the amount to be expected could be told with reasonable accuracy in advance. If the track the storms take from the Aleutian Islands is northern, we get no rain; if the storm enters the United States south of the mouth of the Columbia River, we do get rain; and the farther south the track the greater the amount. I am convinced that the route they will take depends largely on the behavior of the winter high-pressure center of action over Asia."

By the term "centers of action," says Mr. Beals, he refers to rather complicated weather phenomena. These are large areas on the earth's surface where the barometer remains relatively high or low for a long period of time. Eight such centers are known, of which four influence the Pacific weather. The principal one is the area which covers nearly all of Asia, except in the summer. Another is located over western North America, and for much of the time it reaches out over the Pacific. An important low-pressure area extends over the Aleutian Islands and, like the other two, disappears in the summer. At that time, says Mr. Beals, a large high-pressure area appears over more than half of the north Pacific Ocean.

FISH OF THE WATERS OF YELLOWSTONE PARK

OCCASIONALLY fish are found in the waters of Yellowstone National Park which have come from the Pacific Slope drainage area, and which have crossed the Continental Divide in the course of their migration.

At the time of the park's creation in 1872 its waters were barren of fish. This was due to the fact that the park is a volcanic plateau several thousand feet higher than the surrounding region, and every stream that flows out of it has one or more falls in its course that carry it down to the lower elevation.

Early explorers to the region, however, had noted that Yellowstone Lake, and the Yellowstone River, both above and below the falls, abounded in a species of trout. For long this could not be explained, since the fish, coming up the river, could not surmount the falls to reach the upper river or lake. Then it was discovered that the fish were practically the same as the cutthroat trout of the Pacific Slope. Careful investigation revealed the fact that at Two-Ocean Pass, south of the park, the headwaters of the Yellowstone mingle with those of the Snake River of the Pacific drainage in a grassy, alpine meadow, on which the water often stands deep enough in the spring, when the trout ascend their native streams to spawn, for the fish to cross from one side of the Continental Divide to the other. This explanation was later completely verified by Dr. David Starr Jordan, who observed the trout passing from Pacific to Atlantic Creek.

The excellent fishing now obtainable in Yellowstone Park is the result of artificial fish planting. The Federal Bureau of Fisheries maintains a hatchery on Yellowstone Lake, and last year 5,891,000 black-spotted trout from here were distributed throughout park waters.

BLUE GLOW IN AN ELECTRIC LIGHT BULB

A MYSTERIOUS and as yet unexplained blue glow in a special light bulb is puzzling members of the department of physics at Johns Hopkins University. The effect was noticed by Dr. Joseph Kaplan while trying to get hydrogen in atomic, instead of molecular form. The apparatus consisted of a large glass bulb, in the bottom of which had been sealed the filament from a 300 watt tungsten lamp. Varying amounts of hydrogen, under low pressures, were allowed to enter the bulb.

In a report to *Nature*, Dr. Kaplan describes the effect as follows: "The filament was allowed to come to incandescence, the observer very carefully shielding his eyes from the direct light of the filament. On extinguishing the filament and opening the eyes, it was possible to see a weakly luminous ball of vapor, blue in color, rising from the filament and spreading out into an umbrella-shaped cloud at the top of the bulb. This glow persisted for about a second and then disappeared. The act of disappearance was a characteristic one, the glow appearing to collapse from the wall of the bulb to its center. The speed with which the glow shot up from the filament increased with increased pressures."

When the filament was burned steadily for about

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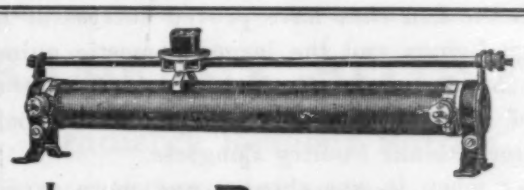

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thirty minutes the glow was no longer observed. Letting it stand for about ten minutes, however, restored the power. This leads Dr. Kaplan to suppose that the glow is caused by something given off from the filament, but that after the filament has been burned awhile, all the carriers of the glow are released. The light is so faint that it has not yet been possible to observe its spectrum, which might furnish a clue to its nature.

YELLOW FEVER

YELLOW fever, which has almost been stamped out in the Western Hemisphere, has flared up in the East. Reports of the cases and control work in French West Africa, which have just been received by the Academy of Medicine, show that the outbreak of this highly fatal plague in Senegal is widely scattered over an immense territory where sanitary measures are difficult to enforce.

The preventive vaccine and curative serum developed by Dr. Hideyo Noguchi, of the Rockefeller Institute for Medical Research, have been used with considerable success in keeping down the number of deaths. In so far as possible patients have been isolated, travelers inspected and war instigated on the deadly stegomyia mosquito that carries the disease.

The International Health Board of the Rockefeller Foundation has taken up quarters at Lagos, Nigeria, where the epidemic is supposed to have started and is making a thorough study of the problem. On account of the lack of transportation and other difficulties in the way of carrying out a scientific program of disease-control in a primitive tropical country, the work of this organization has been confined to the British colonies of Nigeria and the Gold Coast.

Epidemiologists stress the importance of suppressing yellow fever on the west coast of Africa before a transcontinental railway or other avenues of communication are opened up to carry the disease to the East. The stegomyia mosquito flourishes in the warmer countries of the Orient and once the mosquitoes of this genus become infected the havoc that a disease like yellow fever would wreak amid the unsanitary conditions of India and southern China would be appalling and should be prevented at all costs.

TEST ONLY POULTRY FOR TUBERCULOSIS

THE application of the same principles of disease protection to the hen that have proved successful in treating human beings and the larger domestic animals was discussed by Dr. John R. Mohler, chief of the U. S. Bureau of Animal Industry, in a paper read before the Third International Poultry Congress.

The day when it was cheaper and more expedient to destroy a diseased bird or even a whole flock than to call in a veterinary is past. So important is the health of the hen that the extent of such major infectious diseases as tuberculosis among fowls has been mapped out throughout the United States through the cooperation of Federal inspectors and sanitary officials.

To check the inroads of avian tuberculosis which threatens not only poultry but the hog industry as well because it is readily communicable to swine, Dr. Mohler suggested the feasibility of the tuberculin testing of fowls. In this way tubercular fowls would be eliminated from a flock in much the same way that infected cows are now tested and dropped from dairy herds. The method is being used to some extent at the present time and has no harmful effects on normal healthy birds.

Other dangerous infections that cause great losses to the industry will probably eventually be brought under control through the application of the immunization methods that are proving increasingly successful in human medicine.

So great is the demand of chicken raisers for information on poultry diseases that editions of the farmers' bulletin on this subject published by the Department of Agriculture have been issued at the rate of 16,000 copies a month for the last five years, the most popular government bulletin on animal disease.

Dr. Mohler stressed the mutual advantage to be gained from closer cooperation between countries engaged in poultry production to protect themselves from foreign contagion and emphasized the fact that the most effective disease control must be based on the vigilance of the owners themselves and their organizations.

THE DIET IN ANEMIA

ANEMICS who have had to eat liver until they revolted at the word itself may obtain a little variety with apricots, peaches and prunes. Recent experiments at the University of Rochester Medical School by Drs. G. H. Whipple and F. S. Robscheit-Robbins indicate that, although liver and kidney are by far the most potent food materials for the regeneration of the red blood corpuscles, certain other animal organs and several fruits are also effective, and hence can be used to vary the diet in anemia.

A long-debated question in medicine is whether iron must be in organic combination before it can be utilized by the body in regenerating the iron-containing hemoglobin, or whether a simple inorganic salt of iron, such as ferrous carbonate, will suffice. Apparently the form of iron and the quantity in which it occurs are not the deciding factors. Beef kidney contains three times as much iron as does beef liver, but the latter is far more effective in blood regeneration. Raspberries contain more iron than do apricots and peaches, but are inert in blood regeneration. There is certain evidence that some unknown substance is supplied by the effective foods, and that it enables the body to utilize the iron. This is comparable to the use by the body of vitamin D for calcium deposition in the bones.

Apricots, peaches and prunes are about as effective as bone marrow, pancreas and spleen, the Rochester investigators have found. The dried fruits are as effective as the fresh. Raisins, grapes and apples are in a lower class, but are about on a par with brain tissue. All these fruits are far superior to dairy products for this particular purpose.

It is thus apparent that, although liver is the most effective tissue so far found for hemoglobin formation

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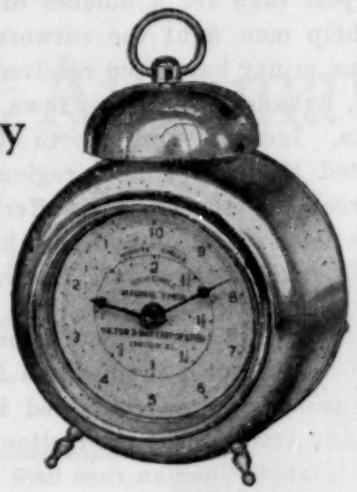

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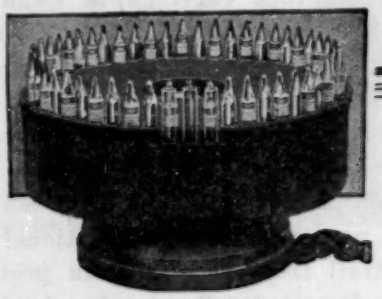

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EXCAVATIONS IN MEXICO CITY

To dig or not to dig, that is the problem worrying Mexican archeologists living in Mexico City, built on and out of ancient and mysterious ruins.

Boosters for a beautiful modern Mexico City want officials to cover up the ugly hole in the heart of the town a few blocks from the Cathedral plaza where ancient Tenoxtitlan, the prehistoric Aztec capital, was recently exposed.

Scientists, however, are anxious to learn as much as possible about the vanished City of the Montezumas, and would like to be allowed to burrow under most of the old buildings in downtown Mexico, even the National Palace and the cathedral.

The most recently discovered ruins in Mexico City are near the cathedral. Dr. Manuel Gamio, former director of archeology of the Mexican Department of Education, believes them to be part of the temple of worship for the two chief gods of the Aztecs, Huitzilopoxtli, the god of war, and Tlaloc, the god of rain.

The temple of Huitzilopoxtli and Tlaloc was part of a larger group of temples known as the Great Teocalli, which was the center of Aztec worship in Mexico. In ancient times it covered many blocks in the vicinity of the present day National Palace and cathedral. The palace of Montezuma was within the Great Teocalli and occupied the place where the National Palace now stands.

When the Spanish conquest was complete, the Spaniards razed the various temples to the ground and used the stones to build Christian churches. Many old Colonial buildings stand over valuable archeological sites, and stone carvings of serpents and other Aztec symbols have been used as decoration in old houses.

The recently discovered ruins are the remains of a great truncated pyramid on the top of which were Aztec idols to which human sacrifices were offered. The floor of the ruins is over twenty feet below the surface of the street.

During the excavations many objects were found which were recognized from the description of the conquistadores and other historians as belonging to the temple of the Aztec god of war and rain. There are craniums and cones carved from stone which decorated the temple of the Huitzilopoxtli and turrets in the form of curved sea shells which crowned the walls of Tlaloc, god of rain.

A serpent at the bottom of a stairway corresponds to that represented in ancient Aztec illustrations on paper of maguey, and many blocks of marble pavement described in the tales of the conquistadores remain. Small representations of the Aztec crossbow were found, and these are probably symbolic tributes to the War God.

ITEMS

CONTINUED wet weather has given an appreciable setback to the chinch bug in the East-Central states and in the eastern half of Kansas according to reports reaching the U. S. Bureau of Entomology. Areas in Illinois that were heavily infested last year are more nearly free from this pest than for a number of years. Wet springs do not help man fight the cutworm, however. Reports of serious injury have been received from Louisiana, Mississippi, Arkansas, Missouri, Iowa, Kansas, Nebraska, Minnesota, Indiana and North Carolina. The already afflicted Mississippi delta regions, from which the water has recently receded, are suffering now from cutworms. Some fields of cotton and corn have been replanted twice, and even three times in a few cases.

BURNING 8,900,000,000,000 tons of coal, 8,900 times as much as the world produces in a year, will release about as much energy as contained in the sunlight captured annually through the production of plant foods. Of this huge total, the human race uses less than two tenths of a per cent., according to an estimate by Dr. John M. Arthur, of the Boyce Thompson Institute for Plant Research. Daily each one of the 1,750,000,000 human beings on the earth consumes about 2,000 calories of food. Even meat comes indirectly from plants. The human race is therefore dependent on photosynthesis, the process by which the plant uses sunlight to form food. The total consumption of food during a year by man amounts to about 1,200,000,000,000,000 calories. All the other animal life, vertebrate or invertebrate, large or microscopic, on the globe are estimated to consume about six times this amount.

WHAT is described as the largest specimen of petroglyphs, or Indian rock carvings in Canada, has been reported to the Archeological Office of the Canadian National Museum at Ottawa. This carving is said to be 250 feet long and located near Yale, B. C. It is carved on a vertical face of reddish rock, sheltered by an overhanging ledge. It is about half a mile south of the eastern end of the Alexander Bridge on the Caribou Highway, and near the Canadian National Railway. A trout fishing trail from which it can probably be seen runs up in its direction. Previously, the largest known rock carving was located on the west side of a seventy foot canyon about one mile south of Mackenzie Highway, in the "Norway of Canada" near Bella Coola, B. C.

If the 250 foot carving is verified, efforts will probably be made to have the region set aside as a national monument.

A HOOK-UP between radio and the movies for scientific purposes has been perfected in Germany, which will permit eminent scientific authorities to lecture to many audiences at the same time, and to illustrate their addresses with motion pictures, no matter how widely separated the various auditoriums may be. The arrangement is relatively simple in principle. In each auditorium the films which are to illustrate the lecture are run on an ordinary projector, geared to a motor which is synchronized with all the other motors in the series, so that each point in all the films is thrown on the screens at exactly the same instant. The lecturer watches one of the projections, or a private projection in his own study, and times his remarks to fit the scenes or processes being illustrated.

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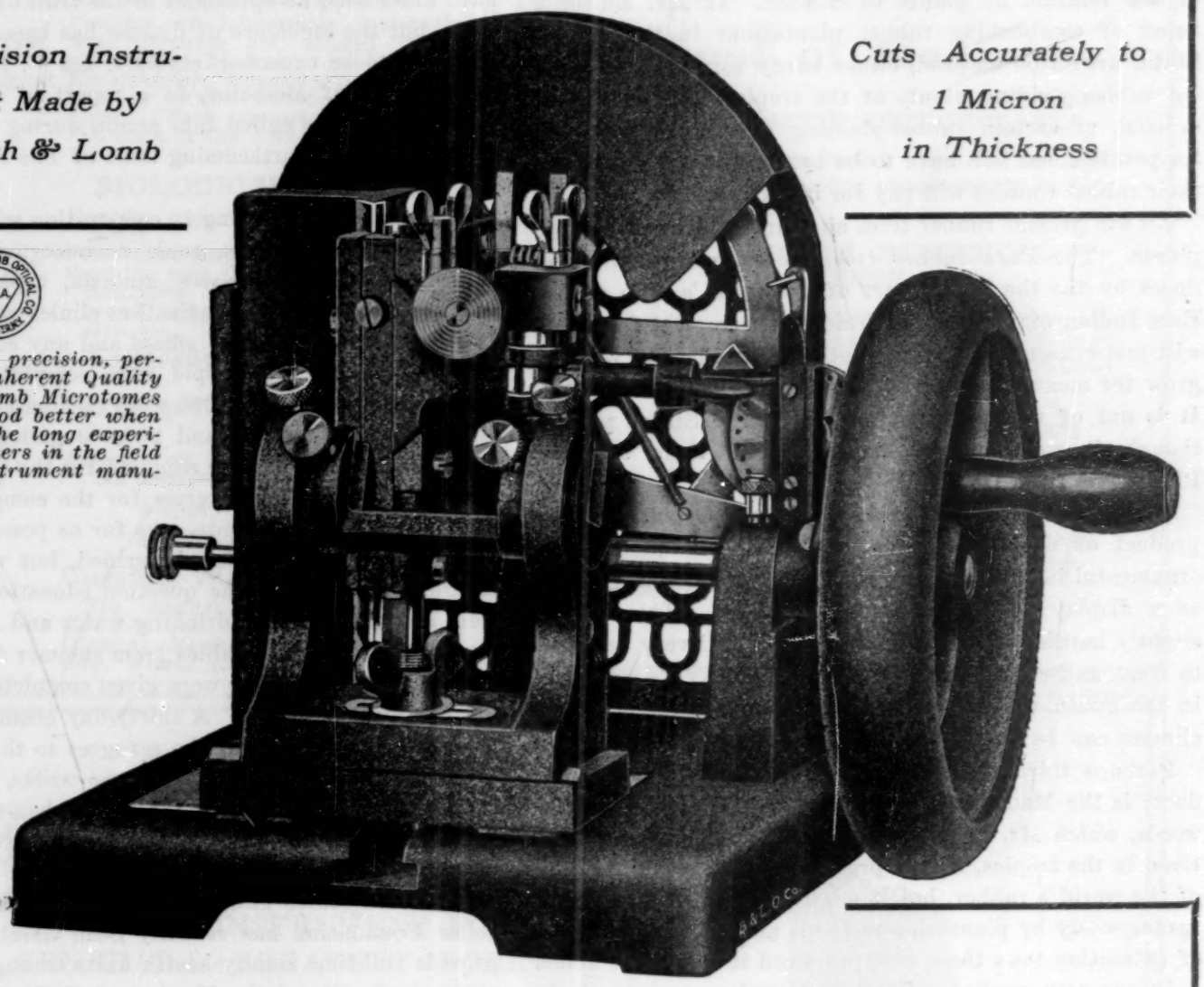

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SCIENCE NEWS

Science Service, Washington, D. C.

RUBBER PLANTS FOR THE UNITED STATES

RUBBER-RAISING in the United States, a project which enjoyed a renewal of public interest following Mr. Edison's recent visit to Washington, is at bottom a problem of the relation of plants to climate. If Mr. Edison's hopes of establishing rubber plantations in the United States are to be realized, either hardy forms of the present rubber-yielding plants of the tropics will have to be evolved, or certain rubber-yielding plants native to the temperate zones will have to be bred up to a point where their rubber content will pay for its extraction.

All the present rubber trees and vines are warm-climate plants. The Para rubber tree, Hevea, which now produces by far the larger part of the world's crop on the East Indian plantations, is decidedly a tropical form. It will just consent to grow in southern Florida, but will not grow for money unless it is permitted to hug the equator. It is out of the question for the United States proper, though it would thrive in the Canal Zone and the Philippines.

The original "India rubber" of the Orient was the product of a species of fig, the same tree used as an ornamental in thousands of apartments, and in larger size as a display piece in many greenhouses. This tree is slightly hardier than the Hevea, but is still very sensitive to frost, and could hardly be expected to pay its way even in the South unless new varieties better adapted to our climate can be produced.

Perhaps third in present importance as a rubber-producer is the Madagascar rubber vin , related to our milkweeds, which Mr. Edison is now trying out in the South. Even in the tropics, it now produces only a small fraction of the world's rubber, but it might be exploited more advantageously by plantation methods and with more means of extraction than those now practiced in its native home.

In our own semi-arid Southwest, and more extensively in the adjacent states of Mexico, there is a native bush, the guayule, which contains rubber in paying quantities. It has the distinction also of yielding its rubber as tiny bits of the pure substance, not as a milky juice or latex which has to be given complicated and expensive treatments before it can be used. Guayule is now being cultivated by a corporation which has a large plantation in southern California, but even this native rubber plant requires the desert heat for profitable growth and holds out little hope of becoming adapted to the colder North.

There remain native plants like the milkweeds and dogbanes, which yield a milky juice containing a little rubber or rubber-like material. These are perfectly hardy in the North, and very prolific—frequently too prolific from the point of view of the farmer. But their content of resilient gums is so low that it would be a bold undertaking to try to make them into commercial sources of rubber, even with the best methods now at the disposal of the plant breeder.

THE PREVENTION OF EPIDEMICS AFTER THE FLOOD

PESTILENCE outbreaks in the Mississippi Valley have been prevented by the nation's health armies. Not only have there been no epidemics in the trail of the great disaster, but the incidence of disease has been less than that normally to be expected, says Dr. Ira V. Hiscock, of the Yale School of Medicine, in a report of the huge scale health operations called into action during the flood, that will appear in a forthcoming issue of *The American Journal of Public Health.*

The Red Cross, working in cooperation with federal and state health authorities, made a concerted drive on the three most feared diseases, malaria, typhoid fever and summer diarrhea. Immunization clinics were established in camps, stores, doctors' offices and any convenient place where some 560,000 people were completely immunized against typhoid and 161,000 were vaccinated for smallpox.

Two tons of quinine and 200,000 gallons of spray oil for mosquito control were supplied for the war on malaria, and a program is in progress for the complete screening of 15,000 malaria patients. As far as possible water supplies were safeguarded and purified, but when such precautions were out of the question educational campaigns were instigated to boil drinking water and milk to protect hundreds of homeless babies from summer diarrhea.

About 600,000 people were given complete care throughout the refugee period. A thirty-day clean-up period followed with the return of the refugees to their homes, free rations and medical service for two weeks.

The need of continuing the public health work in the flooded areas is extremely important. Fortunately a joint program under the auspices of the U. S. Public Health Service, the states and counties affected and the Rockefeller Foundation has recently been developed that will provide full-time county health units throughout the flood region and will put the Mississippi Valley years ahead in the matter of health protection.

THE EARTHQUAKES IN CHINA

THE earthquake of May 22 in the Kansu province of China, happening so soon after that of 1920 in the same region, sets a new record. Never before in the knowledge of Commander N. H. Heck, in charge of the U. S. Coast and Geodetic Survey's earthquake investigations, have two such severe earthquakes in the same region occurred so close together. It was Commander Heck and his associates, using data gathered from seismograph observatories by Science Service, who located the position of the earthquake long before reports from the devastated area reached civilization.

In the earthquake of 1920, an estimated total of half a million people were killed, but according to reports from the region the casualties of the May earthquake numbered about 100,000. The 1920 earthquake was a little nearer

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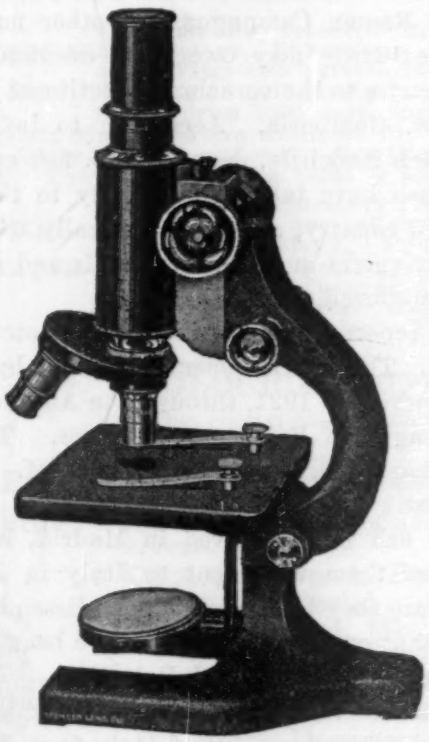

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to Peking, but other reasons are probably responsible for the lower loss of life in this latest one.

The Kansu province has been described as the "Wild West of China." Like our own wild west in the early days, it is a very unsettled region, and there have been frequent uprisings among the people of the region, who are largely Mohammedans. The last great uprising was in 1895, and since then the people have abandoned the cities in great numbers. Kulang, which is one of the cities reported as being destroyed, was described a few years ago by travelers, according to the National Geographic Society, as being nearly deserted and in ruins. Had the cities been as heavily populated as in past years, the loss of life would have been far greater, as the earthquake was one of the most severe on record.

It was across the Nan Shan Mountains, which lie near Thibet, that the May earthquake seems to have been most severe. A little distance to the north of the devastated region runs the famous Great Wall, which ends about 200 miles to the west of it. Practically through the region there ran in the past one of the great high roads into China. In recent times a railroad along the same route has been proposed. The great earthquakes do not necessarily mean that such a project is unsafe, however. Though the country contains geological evidence of earthquakes in the past, until 1920 none had occurred within historic times. Possibly the earthquakes in 1920 and 1927 have relieved the strain of the region, and no more will occur for centuries.

THE USE OF AMERICAN FISH TO FIGHT ITALIAN MOSQUITOES

THE Roman Campagna and other malaria-infested regions of Italy may owe their eventual reclamation for human uses to the voracious appetite of the American top-minnow, Gambusia. According to information received by Lewis Radcliffe, deputy U. S. fish commissioner, these little fish have taken very kindly to the waters of their adopted country, and are practically wiping out the mosquito wigglers in all ponds, canals and ditches where they are introduced.

The report which Mr. Radcliffe quotes covers a six-year period. The first shipment was made by the U. S. Bureau of Fisheries in 1921, through the American Red Cross and the League of Red Cross Societies. Their history since then has been followed by Dr. M. Sella, an Italian scientist.

The fish were received in Madrid, in June, 1921, and some of them were sent to Italy in July, 1922. Since that date they have been widely disseminated in Italy and from that country shipments have been made to Germany, Russia, Jugo-Slavia and Palestine.

He states that the Gambusia has taken up its abode in all the malarial regions of Italy from Istria to Sicily. It does well in small ponds, large lakes, in the large artificial reclamation canals; in waters perfectly fresh and in waters which are slightly salty. It possesses great resistance to high temperatures and other unfavorable conditions, and survives in the smallest residuary puddles after all the native fishes have perished. Despite the difficulties attendant on acclimatization of a new species of fish, Dr. Sella concludes that Gambusia develop better in Italy than in their native land.

In certain ponds where mosquito larvae were counted by millions, now hours are passed in collecting a few dozen.

VITAMIN TESTS

COLOR tests that will tell the amount of vitamins certain types of food contain is science's latest practical project. Dr. Stanley G. Willimott and Frank Wokes, of the University of Cambridge and the University of Liverpool, have been trying out various reagents on foods of known vitamin content to see if it is possible to obtain a satisfactory test for the presence of vitamin A.

Since this is the vitamin needed for growth, the value of a color test that gives promise of actually gauging the quantity in different food stuffs is regarded by scientific men as of prime importance. Under present methods it is necessary to test such preparations as cod-liver oil by the time-consuming process of feeding them to animals and then watching their rate of growth.

It was found that antimony trichloride is the most satisfactory chemical test among those tried out. It produces a beautiful blue in the presence of vitamin A, the depth of which is measured by means of a tintometer. The technique of the process is exceedingly delicate and requires, according to Dr. Willimott, "the careful observation of a number of precautions, some of which are just beginning to be understood. In view of the laborious and costly nature of feeding experiments and the wide margin of error in the results," he explained, "it is obvious that any chemical means which give promise of really estimating the vitamin should be tried on as wide a range of natural products as possible. When the specificity of such tests has been definitely established and a quantitative technique worked out, the way may be open to a new field of investigation of the first importance in human nutrition and well-being."

ITEMS

A NEW plan to give hospital nurses practical training in caring for mental and nervous cases is being tried in Boston, according to a statement by Dr. C. A. Bonner, of the Boston Psychopathic Hospital. Six general hospitals are sending groups of nurses to the psychopathic hospital for three months' intensive training. The student nurses are taught that behavior is a symptom, and they learn to observe and to understand abnormal behavior in the same way that they would observe abnormal physical signs. "In spite of the fact that fifty per cent. of the hospital beds in this country are used for mental patients, only about five per cent. of the nurses who are preparing to care for the sick enter mental hospital training schools. Furthermore, the importance of the mental and emotional condition of patients suffering from physical diseases is gaining recognition. The physically ill person is almost always nervous, and the nurse who understands this aspect of disease is better equipped to care for any sick person."

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SCIENCE NEWS

Science Service, Washington, D. C.

PROTEIN FOOD FACTORS

THE discovery of the vital factors in food is progressing. To our knowledge of vitamins, calories, etc., science in the past decade has added information about the building stones or units of proteins, the amino acids. Protein is found in such foods as meat, bread, cheese, etc. But proteins differ very widely on account of the different proportions of the amino acids constituting them as well as the arrangements of the amino acids in the large protein molecule. By varying the amounts and positions of these eighteen amino acids like eighteen blocks of a puzzle it is possible to build a few million different kinds of protein.

One of the most interesting of these amino acids is that one containing sulphur, known as cystine. Nutritional chemists have shown repeatedly that this is a necessary constituent of the protein food of young growing animals where growth and maintenance of health and body function are to be established. This proves that this amino acid can not be synthesized in the animal body.

Some time ago Professor Carl P. Sherwin, of Fordham University, and coworkers proved this point by poisoning a dog with brombenzene. As this compound requires cystine for its detoxication it was thought that the dog might be able to manufacture cystine in this case of dire necessity. But the dog was unable to do so even when the experimenters furnished it with carbon, hydrogen, oxygen, nitrogen and sulphur as compounds with its food.

Professor H. B. Lewis, of the department of physiological chemistry of the University of Michigan, who has uncovered the chemical fate of cystine in the animal body has recently carried out an interesting experiment. Quoting a report to *The Journal of Biological Chemistry:* "It has long been known that cystine is contained in hair, nails, hoofs, horns and feathers in large amounts. Professor Lewis, in connection with R. H. Wilson, has carried out a most painstaking experiment in which he analyzed various samples of human skin and human hair, comparing them with sheep wool, feathers, rabbit hair, cat hair, dog hair and even tortoise shell.

"He finds that this amino acid, cystine, is exactly the same compound from any one of these sources, but that there is a decided difference in the proportion: human hair, fifteen and one half per cent; sheep wool, twenty-one per cent; feathers, seven to twelve per cent; rabbit hair, eleven to twelve to fourteen per cent; rat hair, fourteen per cent; cat hair, thirteen per cent; dog hair, nineteen per cent; tortoise shell, six and one half per cent. The most interesting part of this experiment is that sex, color and race have little to do with varying the content of cystine in human hair."

DINOSAUR EGGS AND ASIATIC HISTORY

THE discovery of the dinosaur eggs in the Shabarakh Usu Desert of Mongolia means much more to the world of science than the fact that they may now be viewed in a glass case in the dinosaur hall of the American Museum of Natural History. By means of the eggs the ancient climatic history of that part of the world may be read more easily. And as climate is always a basic factor in economic progress the prehistoric story of early animals and early man may more easily be deduced.

As Fredecick K. Morris, one of the geologists of the Central Asiatic Expeditions of the museum, explains, the dinosaur eggs form part of the evidence of the beginning of a gradual change in climate from the warm wet of lush, swampy country to desert aridity. The torrid swamplands were a paradise for the large dinosaurs. But with the gradual drying up of the country these giant reptiles, in spite of their size, found themselves unable to cope with the situation and slowly died out. The approach of aridity foretold the beginning of the end of the living conditions of the dinosaurs of that period. The swamps were replaced by upland conditions and arid to semi-arid climate and the giant reptiles by small, light, rather speedy dinosaurs. It was this smaller species that laid the eggs.

It had long been known that this change in climate took place with its resulting change in fauna. But the dinosaur eggs helped geologists to fix the approximate date of the beginning of this change, at least in Central Asia. And the eggs contributed this evidence by the manner of their preservation. They were preserved in sand. Such sand, so bedded, meant the encroachment of marching dunes on the rookeries where the dinosaurs nested.

The eggs, it was found, had been lightly crushed by a force so slight that it had not completely disrupted the inner lining of the shell under the hard outer shell. The outer shell had been cracked, but the fragments had remained in place, sticking to the inner lining which was evidently almost intact. Only one force could crack the eggs without breaking them and that was the gradually growing weight of sand blown by the wind. The weight of sand blown over the eggs would slowly become sufficient to crack the outer shell and puncture the inner lining without much displacing it. Grains of sand would sift inside the eggs through the punctures till the eggs were completely filled and were solid enough to withstand all further pressure without breaking.

The decision that the eggs were those of dinosaurs was reached by a process of elimination. Dinosaurs, being reptiles, laid eggs. But so did the birds and tortoises of that period. It was deduced, however, that the eggs could have been laid only by dinosaurs as the only skeletons of egg-laying animals found near the eggs were dinosaur skeletons and there were many of those. No bones of birds were found in that spot and none of tortoises except little fragments, while there were countless dinosaur skeletons. Prehistoric bird bones have been discovered in other places, while everywhere else in Mongolia tortoise bones have survived and their eggs have not, showing that where the creatures were present their bones

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have remained. It is unthinkable that their delicate eggs should survive while their bones were destroyed.

Thus those eggs left so long ago by the female dinosaur were filled with sand, buried and lost. As ages passed they were fossilized. Found at last by man, they now point the way to still further knowledge of the history of the earth.

CAMOUFLAGE IN NATURE

THE principle of camouflage by broken color dates for its origin farther back than the late war. In fact, certain reptiles and amphibians have long had arrangements of broken coloring which appear as exotic on close view and conceal as effectively at long range as the most grotesquely painted battleship ready for war tactics.

Some of these strikingly marked creatures are on view in the new Hall of Reptiles of the American Museum of Natural History. Placed in natural settings, they illustrate the camouflage principle by melting into their background. To bring out more clearly the peculiar ability of the camouflaged animal to merge into the scenery, a solid colored specimen is placed beside each camouflaged specimen. Thus the vivid yellow splash down the back of a certain frog catches the attention, making one forget the outline of the frog itself, while a neighboring frog of solid green can be seen at once for just what he is. Likewise the coral snake is shown beside a green water snake in both the daylight and the dark. Being spotted red, black and cream, the coral snake shows up much more distinctly than his companion in the daylight group. But the brilliant creature is a nocturnal animal and in the dark his broken coloring makes him indistinguishable while the outline of the solid-colored snake can easily be traced. Another exhibit shows the happy effect of a light-colored belly in breaking up the outline caused by shadows on the ventral side of an animal. In whole-colored specimens these ventral shadows bring the animal's outline into conspicuous relief.

COFFEE DRINKING AMONG CHILDREN

How much milk and how much coffee did you drink at meals yesterday? This question has been put to 80,000 children of the first eight grades of school in and around Pittsburgh, with results which the investigators describe as "almost startling."

The survey was made by John C. Fetterman, of the Pittsburgh District Dairy Council; M. Lillian Conwell Shillinger, nutrition specialist, and R. Roy Irvin, of the Mellon Institute of Industrial Research. Results just announced show that the average city public school child, in this city at least, drinks 1.47 glasses of milk and .81 cups of coffee a day at meals.

"The average city parochial school child," the investigators state, "drinks .93 glasses of milk and 1.52 cups of coffee, the average county public school child 1.58 glasses of milk and .72 cups of coffee, and the average county parochial school child .89 glasses of milk and 1.37 cups of coffee."

Only a small proportion of the children drank neither milk nor coffee at meals. Comparatively few drank both milk and coffee at the same meal.

The teachers of the children were asked to classify their pupils according to whether they were good, fair or poor in scholarship. These marks were then compared with the beverages drunk by the children.

"There were more 'good' pupils among those who drank only milk than 'fair' or 'poor' pupils," the survey indicates. "On the other hand, there were more 'fair' than 'good' or 'poor' pupils among those who drank coffee exclusively or among those who drank neither, the one exception to this last statement being the city parochial school children, among whom there was a slightly greater number of 'good' than 'fair' or 'poor' pupils in the subgroups consisting of those who drank both beverages or neither."

Children of the better sections of the city averaged 2.13 glasses of milk a day and .31 cups of coffee, as contrasted with 1.19 glasses of milk and 1.10 cups of coffee among children of the industrial sections where laboring and foreign elements predominate.

THE VELOCITY OF SOUND IN LIQUIDS

THE blinking of a red neon light is the index by which physicists can measure accurately for the first time the speed of sound waves in liquids. This has been accomplished by Dr. John C. Hubbard and Alfred L. Loomis, working in the latter's private laboratory at Tuxedo Park, N. Y. It is one of the side products of the researches by Dr. R. W. Wood, of the Johns Hopkins University, and Dr. Loomis on "super-sonics," waves similar to sound waves, but vibrating many times too rapidly to be detected by the ear.

In the new apparatus, which will be described by the experimenters in *Nature*, and is called a "Sonic Interferometer," these same super-sound waves are used. A disc cut from a crystal of quartz, like that used in modern radio stations to keep the wave length constant, only much larger, furnishes the waves. This disc is placed between two metal plates which are connected to a vacuum tube also like that used in radio broadcasting. The tube furnishes a rapidly oscillating electric current. However, while two kilowatts of electrical power were used to run the tubes in the earlier experiments, the sonic interferometer uses only 50 watts, about the same amount of power as used by an ordinary electric light bulb.

When the current is turned on the quartz crystal oscillates, giving off waves which vibrate from 200,000 to 400,000 times a second and from an eight to five sixteenths of an inch in length in a liquid medium. The human ear can not hear sounds which are in faster vibration than about 20,000 a second. The middle C on the piano vibrates only about 256 times a second, and the waves from it are about four feet in length.

A vessel containing the liquid to be tested is placed over the vibrating crystal and the waves travel up through it. Immersed in liquid, parallel to the quartz plate is a metal disc which can be moved up or down by a very small amount. At certain positions of the upper disc, the waves from the quartz are reflected back so that they are exactly in step with the waves coming up from the bottom. In such positions the little neon lamp goes out. By measuring the position of the upper disc, the lengths of the

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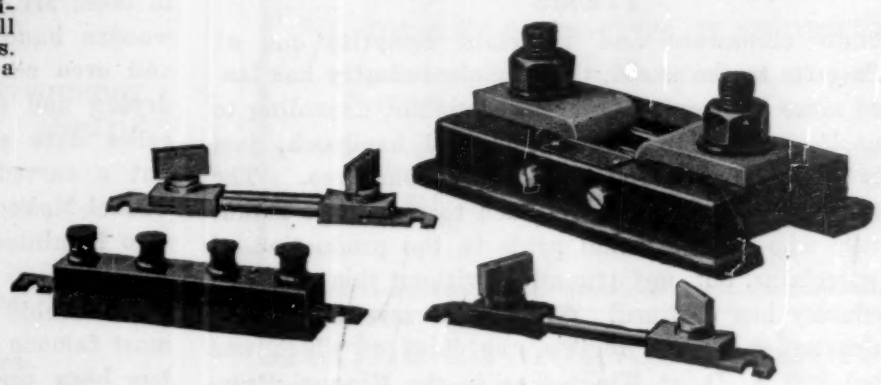

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SCIENTIFIC INSTRUMENTS

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waves can be determined to within a twenty-five hundredth of an inch. The number of vibrations per second of the crystal is known, and so the speed of the sound waves can be measured with an extremely high degree of precision.

As a result of their investigations, Dr. Hubbard and Mr. Loomis find that the sound waves travel through pure water at a temperature of 60 degrees Fahrenheit with a speed of 4,850 feet per second. If the water contains one half of one per cent. of salt, the speed increases to 5,050 feet per second. Increasing the temperature of the pure water to 77 degrees increases the speed to almost the same figure. From previous measurements, the speed of sound in air has been determined at about 1,100 feet per second.

According to Mr. Loomis, this work opens a new field in studying liquids, for by no other method is it possible to measure so accurately sound speeds in them. From these speeds can be calculated the compressibility of the liquid and other important facts about its composition.

ITEMS

THOUGH chinaware and porcelain comprise one of China's gifts to the world, this famous industry has languished since the beginning of the republic, according to "China," a commercial and industrial handbook, just issued by the U. S. Department of Commerce. The patronage of the emperors did much to encourage manufacturers who took personal pride in the production of their porcelains, but, unfortunately, without this stimulus, the industry has declined. There were several imperial potteries under the old régime, the chief of which was founded 200 A. D. at Kingtechen in the Kiangsi Province. Exceedingly beautiful china is still made, according to Commercial Attache Julean Arnold, but it is difficult for tourists to make satisfactory purchases owing to the limited supply of pieces kept on hand. China, however, possesses not only the skilled potters but plenty of raw material in the shape of high quality kaolins and clays.

NORWAY and Sweden are planning to become independent of the rest of the world so far as their oil supplies are concerned. The coal mined at Kingsbay, Spitzbergen, has been found to be especially suitable for treatment by the German Bergius process for making artificial petroleum and a large plant near the mines is contemplated. A report received by the American Chemical Society also states that Sweden will use coal from the mines at Braganza Bay for oil production. The hydrogenation of coal as invented by Dr. Friedrich Bergius, the German chemist, produces gasoline, lubricating oil and an artificial anthracite coal from ordinary bituminous coal.

TWO hundred rare goldfish and fancy carp, a friendly gift from the Japanese Bureau of Fisheries to the U. S. Bureau of Fisheries, have been distributed among aquariums of this country as examples of what delicate and exotic creatures fish can be when they are bred for beauty rather than for food. A few of the fish have been retained for display by the U. S. Bureau of Fisheries. The Japanese fish were sent to this country in return for the American government's courtesy in sending whitefish to Japan. These whitefish have become established in Japanese waters, where they are expected to become a valuable food fish. The Japanese gift fish are from the famous center of carp culture, the village of Yamakoshomura. They are patterned in delicate red, black, gold, silver and opalescent colorings, and have long fluttering fins, a mark of great beauty in goldfish circles.

THREE great caves in a mountain of salt in Nevada have yielded relics of Indian miners who worked there as early as 1000 B. C., to an expedition headed by M. R. Harrington, of the Museum of the American Indian, Heye Foundation, New York City. The great natural salt mass stands near the town of St. Thomas, Nevada, in a desert where rain falls so seldom that it has remained for ages without dissolving, which would have been its fate in a monster region. Underground waters, however, have hollowed the caverns in its interior, and in these Mr. Harrington has found stone hammers with wooden handles, sandals of yucca fiber, carrying nets, and even corncobs, all perfectly preserved through the drying and antiseptic action of the salt. Most of the relics date since the beginning of the Christian era, but a carved club was found of a type used by the Basket-Makers, the forerunners of the present Pueblos, who inhabited the Southwest about 1000 B. C.

AN orchid farm in Panama, containing one of the most famous collections of the costly blooms in the world, has been presented to the Missouri Botanical Garden. It will be used as a tropical adjunct to the garden, according to the director, Dr. George T. Moore. To the 7,000 species included in the original gift orchids from all parts of the tropical world will be added. It is expected to become one of the most complete collections in existence. One of the great advantages of this tropical station will be its utilization as a sort of orchid hospital for the rescue of rare plants that have gradually succumbed to the adverse climate of Missouri. Some of these valuable plants have been sent to the Canal Zone to recuperate. Later, they will be shipped back to the United States.

DR. MIRIAM S. ISZARD, of the department of bacteriology at the University of Pennsylvania, reports that mayonnaise dressing, noted for its inability to "keep," can now be preserved as long as five months. Experiments in the bacteriological laboratory indicated that a spore forming bacillus was responsible for spoilage in mayonnaise. Since bacteria can not survive in an acid medium it was decided to try the effect of the addition of small amounts of lactic acid to the dressing. This acid is harmless from the point of view of health, and it was found that a small proportion would check the growth of the bacteria causing decomposition. It was used in preference to vinegar because it does not affect the taste of the dressing as would the amount of vinegar necessary to inhibit bacterial growth.

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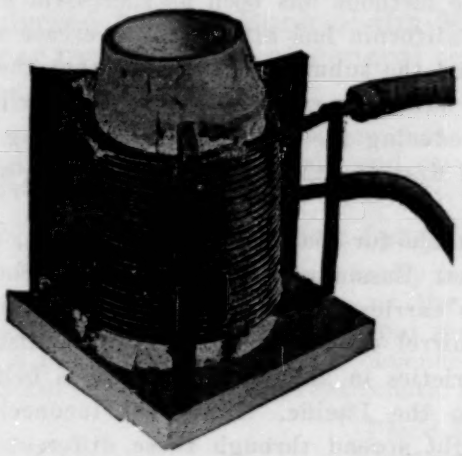

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SCIENCE NEWS

Science Service, Washington, D. C.

INFANTILE PARALYSIS

ARE we on the verge of another infantile paralysis epidemic like that of 1916? Late summer and early fall are the times when this little understood disease is most prevalent, but the number of cases reported to the U. S. Public Health Service in the last few weeks have shown a decided gain over those reported for the same period last year.

The figures just in for the week ending August 6 show 180 cases as opposed to only 66 for the corresponding week for 1926. Ohio reports several widely scattered cases, while California has 56 for this last week alone.

Like influenza, poliomyelitis, as infantile paralysis is known to medical men, is one of the unfinished problems on which scientists are still hard at work. It is believed to be caused by a filterable virus which is spread by contact with articles that have been touched by the infected person. From the way in which epidemics have spread in the past it is thought that it must be transferred either by animals or human carriers, but at this time little has been definitely established on this point.

In the big epidemic in New York City that occurred eleven years ago it was clearly shown that prompt hospitalization of all cases that could be safely moved checked the spread of the disease more effectively than any other measure. Another outstanding point that emerged from this experience was the fact that isolation of groups of children from contact with other children or adults, even when carried out in the midst of areas where the disease was prevalent, sufficed to protect almost absolutely from infection.

At the Rockefeller Institute for Medical Research attempts have been made to immunize monkeys to poliomyelitis, but the results were too variable to be useful.

French workers have tried to use pieces of the dried spinal cord after the same procedure as that followed in rabies treament, but the results were too uncertain to be practical. Dr. E. C. Rosenow, of the Mayo Clinic, has used an antistreptococcus serum to treat acute cases, but this is a recent development that has not received any general application.

BUBONIC PLAGUE IN CALIFORNIA

A CASE of bubonic plague in Los Angeles, announced by the federal health authorities, will probably lead to redoubled efforts to rid cities of the Southwest of the rodents that carry the disease.

Man has to a certain extent developed control of acute plague and its migration from port to port, but little really effective work has been done to control the chronic reservoirs of the disease in animals. The California case was contracted by the patient, a little child, from handling ground squirrels. These animals harbor the disease in a chronic and subacute form, passing it on to each new generation. From them the disease spreads to suburban rodents and from these in turn to city rats, where chances of communicating the infection to human beings are greatly enhanced.

Poison, explosives, traps, guns and gas have all been tried out in extermination campaigns, but the ground squirrel of the Southwest is notoriously prolific, and none of the methods has been as successful as could be desired. California has attempted to create rodent-free zones around the suburbs in the hope that the stamping grounds of suburban rats and city rodents will not overlap, thus reducing the chances of exchanging plain, unadulterated fleas for those that are infected with plague germs.

The valuable fur-bearing marmot of Asia, the souslik of southwest Russia and the gerbille of South Africa also act as carriers of this much-dreaded disease. The ground squirrel of the United States is distributed in various varieties in an almost continuous belt from the Atlantic to the Pacific. It is not inconceivable that plague might spread through these different species of rodents all the way from California to Massachusetts

Rat-proof ships, periodic fumigation, quarantine inspection and building with concrete or other rat-proof material seem to be the best methods to reduce plague possibilities at the present time.

COFFEE GROWN IN CALIFORNIA

MOCHA coffee is the latest addition to the list of California's agricultural products. At least this is the claim of R. C. Wahl and associates of Los Angeles, whose extended experiments near Holtville have convinced them that the United States can grow some of its own coffee. Experimental crops, roasted by San Francisco experts, are said to have yielded a beverage equal to Arabia's finest.

The torrid Imperial Valley, below sea-level, again takes credit for unusual agriculture. The new coffee is not of ordinary species grown in the humid Brazilian tropics, but rather the genuine Mocha indigenous to dry Arabia. This coffee commands high prices and is almost unknown in present-day American trade.

Unfortunately the Imperial Valley sun is too hot for the unsheltered coffee plant. Whence comes the plan to plant alternately rows of coffee with castor-bean or acacia trees. The castor-bean is especially favored for its generous shade. It is hoped further that the bean may pay its way in castor-oil.

In the proposed new coffee belt the subterranean water-level is so far beneath the surface of the soil that growers will have no fear of the flooding and standing water which make trouble on tropical plantations. Ample irrigation on a freely drained, warm alluvial soil is the requirement, and one easily satisfied in the flood-plain of the Colorado.

TESTS FOR ICE CREAM

THE human tongue is a better scientific instrument than it is usually credited with being, at least so far as ice

ADVERTISEMENTS USEFUL TO SCIENCE

"Your Money's Worth; A study in the waste of the consumer's dollar," by Stuart Chase and F. J. Schlink, published in 1927 by The Macmillan Company, has quickly attained a large sale and much influence. It has been selected by the Book-of-the-Month Club as one of the twelve books of the year most worthy of general reading. In the final paragraph of the summary the authors write:

Never believe advertisements of competitive goods (except in scientific journals), and say so, loudly, clearly and on every possible occasion. Thus may ultimately come advertising that you can believe—copy backed by impartial scientific authority.

Earlier in the book (page 162) it is said:

For advertising which really informs and so fulfills a useful economic function, look through a copy of *Science* or the *Physical Review* or *The Scientific Monthly*. These magazines cater to professional men almost exclusively. Here, for instance, is a copy of a page advertisement in *Science* for November 12, 1926: First comes a picture of an instrument; not an impressionistic picture but an informing one.

Price $222.00 f. o. b. New York
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The above tells exactly what the scientific man wants to know about a refractometer if he is in the market for one. There is no attempt to make him yearn for an article that he cannot afford, for the price is given. The statement of accuracy is a real contract upon which the buyer can obtain refund if he finds the instrument not up to the claims.

Under instructions from the editor, the advertising department of SCIENCE seeks to obtain only advertisements that are useful to scientific men, are worth what they cost to the advertiser, and are as reliable as the contents of the editorial pages of the journal. It may not be desirable to reject advertisements that are offered, and statements made are not necessarily endorsed, for a certain freedom must be allowed to signed advertisements such as an editor allows to signed communications. The advertising department will, however, welcome information as to any statement made in an advertisement that may appear to be incorrect or misleading, as it will the assistance of scientific men in obtaining advertisements that are useful to science and in purchasing what they need from advertisers in the journal.

SCIENCE is supplied to subscribers at less than the cost of printing, and advertisements are essential for its support and improvement. In an article entitled "The journal *Science* and the American Association for the Advancement of Science" printed in the issue for October 8, 1926, it is remarked:

Not only SCIENCE, but also those who read it and even those scientific men who may not read it but none the less profit by its existence, are under real obligations to the advertisers who make its publication possible. The advertisements are a matter of business, more profitable it may be hoped to the advertisers than to the journal, but none the less they are thus cooperating with scientific men in advancing their common interests, which are also the interests of the nation. Many subscribers have expressed the opinion that they find the advertising pages one of the most interesting and useful departments of SCIENCE.

THE SCIENCE PRESS

GRAND CENTRAL TERMINAL NEW YORK, N. Y.

cream is concerned. Recent experiments made by the U. S. Department of Agriculture indicate a rather close correspondence between the "taste test" of a large number of people and the more precise determination of quality made by instrumental means.

The first test involved three ice creams of varying butter fat content. These, containing 18, 15 and 12 per cent. were fed to 50 daily purchasers for a period of 10 days. In each instance freezing and hardening conditions were alike, the consumer changing his choice at will. The result was that 82 per cent. of the samplers favored the ice cream of 18 per cent. butter fat content.

The second test proposed to show whether or not sugar strongly affects the palatability of ice cream. An experiment was made with mixes containing 19, 16 and 13 per cent. of cane sugar. About 90 per cent. of the consumers preferred the 16 per cent. composition.

The third experiment tested the effect of non-fat milk solids on the palatability of ice cream. For a period of six weeks three mixes of 12, 9 and 6 per cent. non-fat milk solids were sold. More than 80 per cent. of the 1,185 sales showed a preference for a 9 per cent. non-fat milk solid rather than the commercial ice cream with but 6 per cent.

A debated point among ice cream magnates concerns the popularity of ice cream containing gelatin. For years it was used much as a stabilizer, that is, to prevent the ready formation of ice crystals. Nowadays iceless refrigeration eliminates that possibility, so many manufacturers do without gelatin altogether.

Yet some persons prefer the smooth taste gelatin gives to ice cream. Indeed, experiment four showed that some 63 per cent. of 394 purchasers preferred ice cream with 1 per cent. gelatin. Twenty-three per cent. wanted ice cream entirely without it and others insisted on a content of 0.5 per cent.

Contrary to popular belief, the fat content of ice cream has little effect on the quantity a person will eat. A test was made with two common grades of ice cream, one containing 10 per cent. fat and the other 15 per cent. It was found that the average person can consume 1.2 pints of the 10 per cent. and 1.12 pints of the 15 per cent. cream.

SCIENTIFIC COLLECTING IN CHINA

GOVERNMENT officials in Peking have decreed that no specimens of birds may be exported from China, and only three scientific specimens of any other species of animal or plant life. These regulations, very recently enforced, will greatly hamper foreign scientists who are studying Chinese birds, fish, insects, and other creatures, according to Arthur de C. Sowerby, editor of the China Journal.

The bird law is a hang-over from customs regulations established some years ago to prevent wholesale exportation of pheasants for their skins, he points out. It was never intended to apply to scientific collections, and its revival can not be attributed to any need to save the Chinese birds from extinction at the hands of foreign scientists. Permission to send three specimens of other species back to the museums of Europe or America for study and classification is not an adequate allowance for this purpose, since it is unsafe to describe or classify a species on the basis of so few samples.

The inconsistency of the law is pointed out by Mr. Sowerby, who writes:

"Every year tens of thousands of skins of antelopes, deer, foxes, wild cats, leopards, raccoon dogs, martens, minks, civets, badgers, squirrels and many other animals and the feathers (not the skins) of all sorts of birds in huge quantities are shipped out of China in the course of trade. For years immense numbers of game birds were shipped out of the country in cold storage for consumption abroad, and to-day tinned games of all sorts is sent out, while passenger steamers load up with their supplies of game in China without let or hindrance.

"Millions upon millions of fish are taken from the streams and rivers every year and consumed as food. Thousands of musk deer are killed every year in China and the musk-pods exported to the perfumeries in Europe and America. Thousands of deer are killed every season for the sake of their horns, when in velvet, which are used as medicine.

"All this without the vestige of a regulation controlling the slaughter—yet the scientific collector, the man who is working for the benefit of mankind in general and for China in particular, is prohibited from exporting more than three specimens of any one species of beast, fish, reptile, insect, amoeba, or plant, and is not allowed to send a single specimen of bird out of the country."

China has no museums or libraries adequate for identification and classification of new species, and unless specimens can be shipped to foreign institutions it will be many years before the useful and dangerous wild life of China can be understood, he says.

PREHISPANIC RUINS IN MEXICO

IMPORTANT prehispanic ruins in northern Mexico of a civilization that bridges the gap between the Pueblo culture in the southwestern United States and that of the more advanced culture of the Aztecs and Mayas in southern Mexico have recently been inspected and studied by Dr. Eduardo Noguera, of the department of archeology of the Mexican Department of Education.

The ruins are of a fortified city on the crest of a hill about thirty-five miles southeast of Zacatecas, the capital of the state of that name. The locality was apparently chosen for defense, Dr. Noguera says, and suggests that the prehistoric town was surrounded by enemy tribes. The hill is about 500 feet high and over 3,000 feet long at its greatest point, and where it is not naturally defended by steep cliffs it is surrounded by stone walls which are double in some places.

The hill is a series of five terraces, and each terrace has its groups of buildings. The approach is guarded by a small pyramid and from there an avenue leads uphill to the first terrace. Minor avenues lead to other parts of the hill and to other edifices.

On the first terrace is a great "salon" about 130 by 100 feet. It is surrounded by a wall, and within are eleven pillars constructed of stone. They are at irregu-

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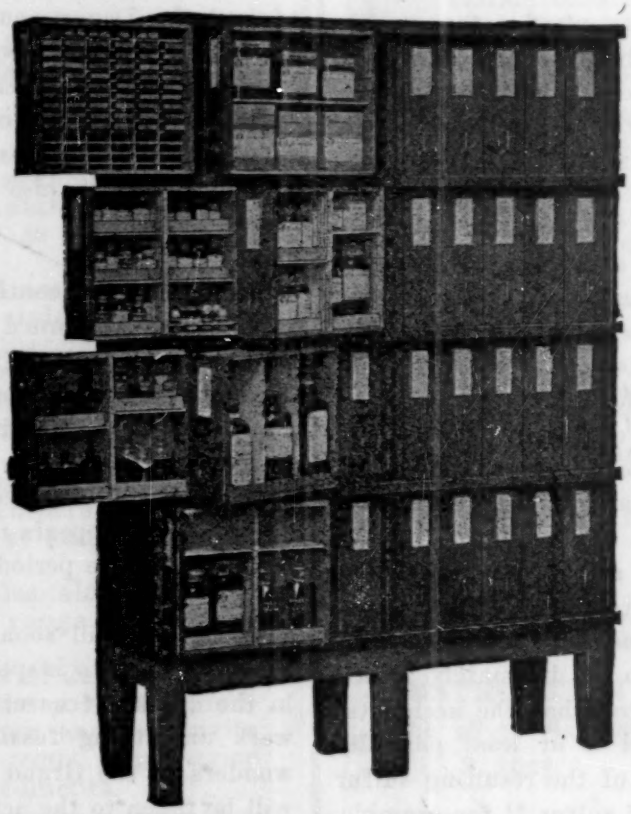

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lar distances from each other, but are placed at regular distances from the walls. Their purpose is a mystery. Even in their ruined state the highest of them are over seventeen feet.

This salon leads to another many times larger and also surrounded by walls which open at the east end and give access to a small pyramid. A third pyramid on the same terrace is of a peculiar structure in that its top is not truncated as in the case of all other known pyramids of the Mexican Indians. It is about fifty feet high and thirty-five feet at each base line.

A fourth pyramid of this ancient Indian city has a series of rooms of different sizes built into one of its sides. Although this structure is in a very bad state of ruin, the material that remains gives an idea of what it was in its heyday.

The best preserved edifice of all is another pyramid in an adjoining quadrangle. It is thirty-three feet high and has a series of rooms or living quarters.

SULFUR DUST

SULFUR grains as small as one twenty-five thousandth of an inch in diameter were described as a powerful new pest-killer in a report to the recent meeting of the American Chemical Society. The remarkable new preparation was announced by its discoverer, Dr. Ludwig Rosenstein, of San Francisco.

Recently finely divided sulfur powder has attained great importance as a material for dusting grape, orange, asparagus and other plants afflicted with insect and fungus pests. The sulfur seems to be acted on by moist air to give products which attack the pest. Unfortunately, sulfur is not directly soluble in water, so that its usefulness depends principally on the amount of surface of the solid powder; and no ordinary grinding process will divide the sulfur into grains as small as those of the new product.

Dr. Rosenstein's new ultra fine sulfur comes as a by-product of his new process for extracting the undesirable hydrogen sulfide from household fuel gas. In the process a little nickel sulfide happens to be intimately mixed with the sulfur, and it is suspected that the accidental presence of this nickel compound is at least partially responsible for the great potency of the resulting sulfur dust. While ordinary "flowers of sulfur," for example, will kill the red spider pest fairly readily, the new dust kills both eggs and mature insects. Other results as reported by the University of California experiment station are equally promising.

The by-product sulfur seems to exist as minute globules of a spongy suspension of water in sulfur suggestive of water-soaked grains of gelatin or starch, and may derive value from this condition.

Fortunately the gas-purification process is so successful that a large supply of the new sulfur is likely to be available shortly. One Pacific coast gas company alone will have 3,600 tons of sulfur per year to work out in this way if demanded.

ITEMS

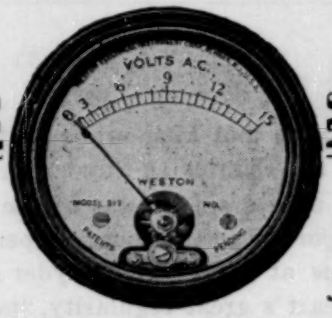
FIRST evidence that Scotland was inhabited by cave men in the Old Stone Age has been obtained as a result of excavation in caves of northern Scotland. James E. Cree, who directed researches in four cases, under a grant from the Royal Society of London, has reported the discovery of two human skeletons in connection with bones of bears and other animals of frigid climates. Further evidence of man's occupation of the caves in ancient times was found in a lower level of gravel containing antlers and bones of reindeer together with tools of reindeer horn, antlers cut and scratched by human beings, and bits of charcoal which showed that fires had been burning. These finds are the first indication that there were any human beings in Scotland as far back as the Paleolithic Era, which ended some 10,000 years ago. Mr. Cree's researches have disclosed the first bones of cave-bears and arctic foxes to be found in Scotland. Further search for traces of Stone Age culture will be made during this summer, it is planned.

BLOOD tests to determine questions of paternity can safely be used as legal evidence, the medical faculty of the University of Lund, the next oldest in Sweden, has advised the Department of Health in Stockholm in response to a formal request for advice. In the making of the tests certain careful precautions are demanded and it is suggested in cases where the blood tests give no definite results, as does occasionally happen, that finger-print tests which also tend to prove blood relationship should be used.

THE record for continuous sleep is believed to be held by a land snail owned by Walter F. Webb. This little mollusk has remained dormant for thirty years, with the exception of one summer when Mr. Webb gave it the right condition for becoming active. This interlude occurred twenty years ago, so that the snail has now equalled the fabled record of Rip Van Winkle, and its owner says it appears to be able to continue its dormancy for an indefinite period.

Telescopes will soon be used to allow visitors to the Grand Canyon to inspect the latest geological discoveries in the depths of nature's great gully. Scientists are at work unearthing fossil footprints and other geological wonders in the Grand Canyon National Park. Visitors will be taken to the actual sites, but an observatory situated on the canyon's rim will allow a preliminary introduction to the various discoveries.

THE language of Tut-ankh-amen and Rameses is now available in terms of modern speech, as a result of co-operation between American and German brain and capital. The publication of the first volume of a great Egyptian dictionary has been announced in Berlin. The work is edited by Professor Adolph Erman and Professor Hermann Grapow, and represents the fruit of twenty-eight years of research on over a million and a half of texts and inscriptions. In acknowledging the assistance received from sources all over the world, the editors make special mention of the cooperation of Professor J. H. Breasted, of the University of Chicago, noted Egyptologist, and of the financial support of the enterprise by John D. Rockefeller, Jr.



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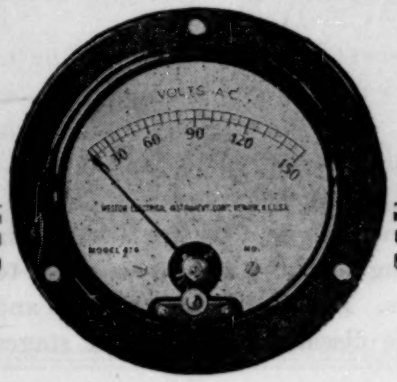

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SCIENCE NEWS

Science Service, Washington, D. C.

A "NEW" STAR IN THE MILKY WAY

A "NEW" star, flashing out from previous obscurity, has just been found in the Milky Way, according to Dr. Harlow Shapley, director of the Harvard College Observatory. The discovery of a strange celestial object was made by Dr. Max Wolf, of the observatory at Heidelberg University in Germany. Photographs made at the Harvard Observatory have confirmed the fact that it is really a "nova" or new star.

However, though the discovery has just been made, the new star might have been detected several months ago. It first appeared sometime between June 8 and June 21, and was photographed on plates made at the Harvard Observatory during that period. As it is in a region of the sky where thousands of stars can be photographed in a single exposure, it is not surprising that its unusual character was not noted at the time. Plates made before June 8 showed no record of it, though they were capable of showing stars as faint as the sixteenth magnitude. From such an exceedingly faint object, it quickly rose to the eighth magnitude, too faint to be perceived by the unaided eye, but visible in a small telescope.

Now its light is on the wane, and it is of the ninth magnitude. An effort is being made to have American astronomers observe it, to measure its variations in light before it gets too faint to be readily observed. Photographs of its spectrum will also be made.

Astronomically, the position of the nova is given as 18 hours and 52 minutes right ascension, and 3 degrees 25 minutes south declination. This is in the constellation of Antinous, a group visible in the southern sky in late August evenings. It is just below and to the west of the bright star Altair, in the Eagle, which towards the end of August is directly south at about 8:00 P. M.

A nova is really the explosion of a star, and is the most vast of all known physical catastrophes. But despite the violence, the stars that are affected seem to be pretty much the same after the outbreak as before. Though they are not all bright enough to be observed, it is estimated that ten novae occur in our stellar system in a year. This precludes the possibility of one theory that has been suggested for their origin, that they are caused by collision between two stars. The stars are so sparsely scattered in space that such a collision would be millions of times rarer.

The tremendous energy which is liberated is now believed to be due to a breaking up of the atoms of which the star is made. Some internal condition might start it, or some collision with a very small body in space might act as the trigger to set it off.

HEAT GIVEN OFF BY THE HEART BEAT

A QUITE normally beating heart, like an automatically equipped storage battery, "discharges" and "recharges" within the period of each beat. From his researches on the hearts of turtles and king crabs at the Johns Hopkins University, Dr. Charles D. Snyder and his associates have found that even a single beat of the heart will produce heat in proportion to the energy expended.

"This explains at last," Dr. Snyder declared, "the wonder of the heart's great regularity, its constant vitality and the age-long mystery of its indefatigability."

In their experiments every precaution was taken to exclude heat from outside sources. The hearts of turtles and king crabs were used because they will keep beating a long time after the animal itself has been killed. A small thermos jar was placed inside a larger one and in the cap of the smaller jar were fixed hard rubber posts to which the muscles were attached. Through the cap were perforations for the wires connecting the thermopile with the galvanometer for recording heat and for a thread connecting the muscle with the lever outside that recorded the tension. The desired temperature in the inner jar, usually 1 to 3 degrees Centigrade, was maintained with ice. The sensitive thermopile, or heat detector, was placed in close contact with the surface of the muscles, and both heat and tension were finally recorded on a moving photographic film.

It was found that the heart of the king crab produced on the average 71 millionths of a calory per centimeter of length for each gram of tension exerted and that the ratio of heat produced to the tension exerted per gram of weight of muscle was fairly constant throughout the series of experiments.

THE USE OF ULTRA-VIOLET RAYS IN ANIMAL DISEASES

How ultra-violet radiation, used on sick humans, saved the lives of five valuable and desperately ill animals in the New York Zoological Park, is told by Dr. Charles V. Noback, of the department of comparative medicine.

His furry patients consisted of a red howling monkey, a grivet monkey and three lemurs, which are small animals belonging to the same order as monkeys but lower in the evolutionary scale. They are all expensive animals, and their threatened death from "cage paralysis," which is a disease very similar to rickets in human beings, was regarded by the zoo authorities as a genuine impending calamity. When they had reached a state in which they refused all food and could hardly move, Dr. Noback was called in.

The helplessness of the animals at the outset simplified the treatment. Dr. Noback simply placed his quartz-tube mercury vapor lamp behind their bowed and immobile backs and turned on the current, without needing to tie or constrain them in any way.

The treatment was kept up for a month in the case of the red howling monkey, and from three to four weeks with the others. In all cases the stiffness and decrepitude that marks the disease in its extreme stages soon disap-

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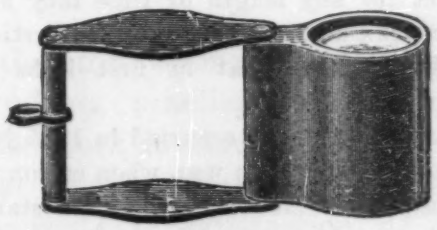

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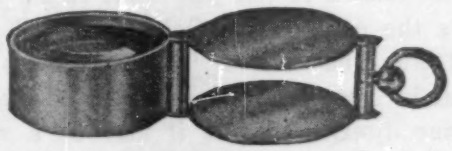

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peared, the eyes became bright again, the hair glossy and the patients displayed a manifest renewal of their interest in food.

Dr. Noback notes that the doses of the rays to which he subjected the hair-covered skins of his animals were much more intense than those intended for the bare skin of a human being. For this reason he had to be careful about hairless and non-pigmented areas, such as the region around the eyes, to avoid producing severe sunburn.

EPIDEMIC OF PELLAGRA IN THE FLOOD REGIONS

PELLAGRA, the poverty disease that visits the South when times are hard, is expected to exact its toll from the states inundated by the flood.

Foreseeing the possibility of a grave epidemic of this disease, which is caused by insufficient food, the U. S. Public Health Service has detailed its dietary expert, Dr. Joseph Goldberger, to the flood area to make a preliminary survey of conditions among the hundreds of homeless survivors. Upon the information that he will collect a relief program will be built up to check, in so far as is possible, wide outbreaks of pellagra such as have always afflicted the South in times of economic depression in the past.

Since pellagra is caused by a faulty, unbalanced diet the ammunition to be used against it is food. Fresh lean meat, milk, cheese, green vegetables and eggs taken regularly are both the cure and the preventive for this disease. Some investigators have thought that pellagra was caused by a germ, but tests made by Dr. Goldberger have proved that it is due to diet alone.

"The three M's, meat, meal and molasses" are its commonest cause in the estimation of the Public Health Service experts. In the southern states when times are hard fat meat with corn meal and molasses are the principal foods of many people. If they continue to live on this diet for any length of time they are very likely to become weak and nervous, have indigestion and break out with an eruption that at first looks very much like sunburn.

The worst epidemic occurred in 1915 just after the outbreak of the European war, when cotton could not be sold and business in the South was at a standstill. In 1917, when the rise in food prices began to affect the tables of the South, there was another aggravation.

While doctors know that proper food will cure pellagra, they are unable to tell just what factor in an unbalanced diet is the cause. Dr. Goldberger believes that he has found what he calls a "dietary factor P–P" that is present in fresh milk, yeast and fresh beef, that will prevent the disease. While it may be a vitamin, it is not identical with any of the vitamins hitherto discovered and described. Dried yeast, which is believed to contain this element, has proved very satisfactory in treating severe cases.

VITAL STATISTICS

So far 1927 has been an exceptionally healthy year, judging by figures just issued by the Metropolitan Life Insurance Company.

Fewer people have died in the first half of this year in the representative slice of the population included among the company's policy holders than during the corresponding period of any previous year. The white death rate for the six months was 8.6 as compared with 9.7 for the first half of 1926. The colored mortality figures, though higher than those for whites, also showed a decided improvement.

The nearest approach to the present figure occurred in 1921, when the rate for the first six months was 8.7. The statisticians point out, however, that the gain made in 1927 is greater than appears from mere comparison of figures, since the company has recently adopted the policy of insuring infants under one year of age, the period during which susceptibility to disease is greatest. Consequently the gain in lives of 1927 is considered a most encouraging indication of health conditions in the light of the fact that some 492,000 infants are included in the calculations.

The outstanding feature of the year's health record to date is the big drop in deaths from tuberculosis. The season of the year when the most deaths from tuberculosis occur is past, and it is hoped that 1927 will show a new low-water mark for deaths from this disease.

Mortality from influenza and pneumonia were lower than they have been in several years. While the typhoid rate rose, due probably to the outbreak in Montreal, there has not as yet been any notable increase from conditions arising from the Mississippi flood. Measles, scarlet fever and whooping cough have claimed fewer victims, but diphtheria has made a slight gain. The cancer situation is unimproved and shows a slight increase in the number of deaths among whites and a bigger gain among colored people.

In spite of the generally hopeful conditions with respect to disease, the record for violent deaths is high. One fourth of all the accidental deaths were automobile fatalities, while the drownings registered a ten per cent. gain among whites and actually doubled among Negroes.

THE FISH IN AN ACRE OF WATER

AN acre of cultivated land will produce on the average about 140 pounds of beef and 300 pounds of pork. Our knowledge of the productiveness of similar water areas is very meager and those who have had the hardihood to suggest that such areas could be made as productive as equal areas of land have usually been considered unduly optimistic.

During the past summer the U. S. Bureau of Fisheries devoted several ponds at its Fairport, Iowa, station to determining how much fish an acre of water will produce. In water farming, consideration must be given to the best species of fish to use, the proper amount of fertilizer necessary to produce an abundant plant and animal life to serve as food, the introduction of forage fishes which will serve as an additional food supply for the market stock, etc.

According to the U. S. Fisheries Service, a pond 3,200 square feet in area was stocked on May 4 with 300 select blue-gill yearlings. The pond was fertilized

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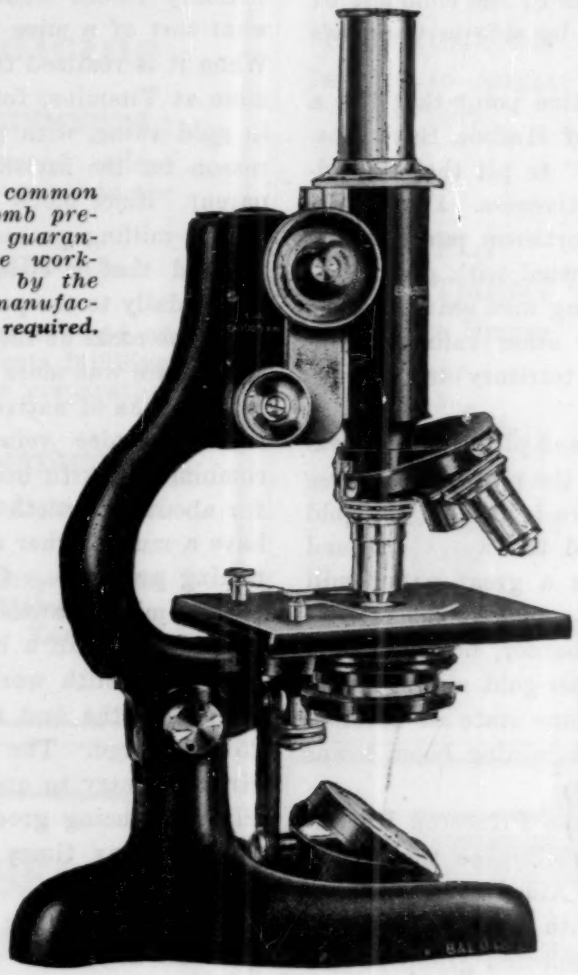

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SCIENCE NEWS

Science Service, Washington, D. C.

MINES AND EXPLORATION IN CANADA'S "NORTH COUNTRY"

WATSON DAVIS, managing editor of Science Service, writes from the special car "Princeton," of the Princeton geologic expedition, that two eras of the conquest of America's natural resources lie side by side in Canada's "north country."

From Cochrane, the railroad junction point that lies a hundred miles from the lower end of Hudson Bay, prospectors still go out into the "bush" to pit their knowledge and luck against nature's secretiveness. During the short summer season the great northern part of the Canadian province of Ontario is spotted with geologists, engineers and plain self-taught mining men searching for rocks rich in gold, silver, copper or other valuable mineral. Hundreds of square miles of territory are still inadequately explored.

Yet great modern industrial plants and pleasing towns exist within a mere thirty-five miles of the place where these prospectors outfit. At Timmins there is the largest gold mine in the western hemisphere and the world's second largest. At Iroquois Falls there is a great paper mill that converts forests into newsprint paper at the rate of 525 tons a day. Over the Quebec border, but not much farther away, is Rouyn, a new copper-gold mining camp that is now in approximately the same state of development as that of some of the western mining boom towns forty years ago.

To this great mineral storehouse the Princeton University Summer School of Geology, traveling on the special car "Princeton," has paid a visit. Aided by the experts engaged in mining operations and with the cooperation of the Canadian Geological Survey, a selected group of students and professional geologists have inspected some of the mines, mills and the rocks which are now pouring forth wealth at the rate of about a hundred million dollars a year.

This mineral treasury is some 500 millions of years old at least, for it consists of rocks known to the geologists as "pre-Cambrian." Over the largest portions of the provinces of Quebec, Ontario and Manitoba there is a great shield of these pre-Cambrian rocks in which there have been found important areas rich in metals. Pre-Cambrian rocks are the oldest found on earth. In part of them there is no trace of life and in others the remains of a few extremely primitive plants and animals have been preserved. But the violent changes in these rocks, the rush of hot masses into them and the great pressures that such changes produced were favorable to the concentration of gold, silver, copper and other minerals. This rich pre-Cambrian shield is interesting not only to the mining engineer and the prospector who hopes for riches, but also to the geologist who is engaged in puzzling out the way in which the crust of the earth was formed.

One may logically expect to see gold in a gold mine. But in the Porcupine gold district it is possible to walk throughout miles of stopes and witness the whole milling process without seeing even a speck of the shining yellow metal. The inspection of a choice piece of ore through a magnifying glass may reveal a few bits of gold but the ordinary visitor would have little chance of finding out what sort of a mine he was visiting if he were not told. When it is realized that the average ore of the Hollinger mine at Timmins, for instance, runs only $7 to $8 a ton in gold value, with gold worth about $20 an ounce, the reason for the invisibility of the metal in the ore is apparent. Since 6,000 tons go through the crushers and intricate milling process of that mine each day, it will be realized that a considerable quantity of gold is being added daily to the precious metal vaults of the world.

To the rocks of the Cobalt district, Ontario's silver center, nature was more bountiful. In the mines around Cobalt, chunks of native silver can be seen and easily identified in choice veins. Here also silver is found in combination with other elements. Since silver sells now for about a fortieth of the price of gold, silver ore must have a much higher metallic content in order to make the mining profitable. Cobalt has been one of the most successful mining areas of the world, and while its heyday is over it is still a big producer.

A blacksmith working by the side of a railroad cut discovered the first silver ore at Cobalt. That was only 25 years ago. The railroad was being pushed into the virgin country to open it for farming. Undoubtedly the silver-producing ground had been tramped over by prospectors many times before the railroad construction revealed it.

Seeing miles upon miles of unsettled country raises the question as to how many other mines of precious metal lie hidden still in Canada's great "north country."

THE GROWTH OF POPULATIONS

PEOPLES rise, flourish a while in their prime, then dwindle away until no increase in their population growth is perceptible at all, all in accordance with a universal law. Such is the gist of the address made at Geneva by Dr. Raymond Pearl, director of the Institute for Biological Research at the Johns Hopkins University, before delegates to the World Population Conference.

This characteristic manner of growth, which he maintains holds good not only for human populations but for living organisms of all sorts, Dr. Pearl described as follows:

"The population at first grows slowly, but gains impetus as it grows, passing gradually into a stage of rapid growth, which finally reaches a maximum of rapidity. After this stage of most rapid growth the population increases ever more and more slowly, until finally there is no more perceptible growth at all, in short, the populations of various forms of life first wax in their speed of growing and then wane."

Data from experimental populations of yeast, bacteria

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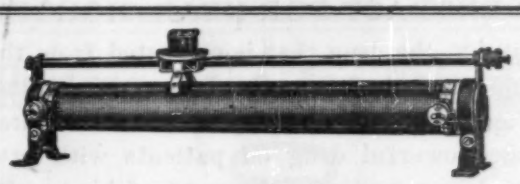

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and that most used laboratory animal, the fruit fly, carefully watched and counted in his laboratory, were cited by Dr. Pearl in proof of his contention that the rise and fall of all populations can be depicted by the same general curve.

"Furthermore," he declared, "it has been demonstrated statistically that populations of human beings have grown according to the same type of curve, so far as may be judged from the available census records in at least the following countries: Sweden, United States of America, France, Austria, Belgium, Denmark, England and Wales, Hungary, Italy, Norway, Scotland, Servia, Japan, Java, Philippine Islands, Baltimore City, New York City, and in the world as a whole. In the case of the countries named the census records do not extend over a sufficiently long time to make the case conclusive that population growth, if undisturbed, would follow in human groups the complete course exhibited by the yeast population just discussed. The available data only make such a conclusion probable. And one can not conduct experiments with human beings on this point, as can be done with lower organisms. But fortunately it has been possible to find one group of human beings, the indigenous native population of Algeria, in which a cycle of population growth has been practically completed during the period for which census records are available, these having been carefully made by the French. In this case the human population followed in its whole cycle of growth a curve of the same characteristic form that has been discussed for the yeast."

GLAND EXTRACT FOR NEAR-SIGHTEDNESS

EPINEPHRIN, the drug that is extracted from the suprarenal glands, may be a remedy for near-sightedness. Dr. Meyer Wiener, of St. Louis, has tried out minute quantities of the powerful drug on patients with progressive myopia, and in a preliminary report of his results to the American Medical Association states his belief in its value in correcting this derangement of vision.

Medical opinion as to the cause of myopia is divided. It is thought to be hereditary within certain limits. Application to close work has also long been blamed as a causes of the failure of the eyes in its progressive phase. Most physicians agree that the stretching of the outer layer of the eyeball is an important factor, but just how this comes about is still a mystery.

Exercise and diet, it is generally agreed, help as much as anything. The ranch life of Theodore Roosevelt is a classic example of what fresh air and out-of-door work will do to help bad eyes as well as the physique generally. It has been proved that exercise increases the epinephrin output of the suprarenal glands, and it is to this factor that Dr. Wiener attributes the improvement that short-sighted people gain from physical exertion.

"It is shown," he stated, "that both exercise and diet influence the secretion of the suprarenals, and that the local application of suprarenal secretion increases tissue metabolism. It is quite possible that the cramped position often assumed in reading and close application of the eyes might have a deterrent effect on the secretion of the suprarenals."

Acting on this theory, Dr. Wiener began the practice of instilling small amounts of epinephrin into the eyes of patients with progressive myopia. He recommended at the same time exercise and fresh air, but restricted reading only to the extent that it must not interfere with the daily exercise. His cases following this procedure have shown such encouraging results that further reports are awaited by medical circles with considerable interest.

DIVERSIFIED CROPS AS A REMEDY FOR PELLAGRA

PERMANENT relief for the pellagra outbreaks that have threatened the South whenever times are hard may be one of the outcomes of the Mississippi flood. A farming program of diversified crops is the chief preventive for the deficiency disease that has broken loose in epidemic proportions in the inundated territory, according to the U. S. Public Health Service experts who recently completed a health survey of the flood area.

Modern preventive medicine that successfully warded off epidemics of typhoid, malaria, dysentery and smallpox in the flooded states has been powerless to check the spread of this poverty disease of unbalanced diet. Dr. Joseph Goldberger, nutrition expert, and Dr. Edgar Sydenstricker, statistician, declare that 2,300 to 2,500 deaths may be expected in 1927, an increase of from one fourth to one third over last year. The number of cases, they estimate, will run up close to 50,000.

Fresh lean meat, milk, cheese, green vegetables and eggs are the ammunition needed to prevent and cure this disease that has been an unwelcome accompaniment of financial depression in the South for many years. The increase of cases in 1926, a year of low cotton prices, was 80 per cent. over the year before. Over half the cases this year come within the confines of the flood states of Arkansas, Mississippi, Tennessee and Louisiana, a section where it has been prevalent ever since the disease was first recognized in 1908.

Diversified farming in these states will go far toward stabilizing the economic status of the tenant farmer and helping him to raise for himself a supply of proper food, the Public Health Service officials point out. The establishment of swine, cattle and poultry industries should be encouraged as well as community or plantation dairies and truck patches, they believe, if the poor white and Negro population are to fend off inroads of pellagra in the future.

Immediate measures recommended are the supply of relief agencies in the flood areas with foods rich in pellagra-preventing vitamins.

HATCHING BLUE GEESE IN THE NATIONAL ZOOLOGICAL PARK

BECAUSE of the hitherto unrecorded feat of hatching and rearing the mysterious blue goose, one of the highest honors given for contributions to natural science has been conferred upon the National Zoological Park. The silver medal of the Société d'Acclimation of France has been accepted for the society by Ambassador Herrick in Paris and has just been transmitted by the State Department to Dr. Alexander Wetmore, assistant secretary of the Smithsonian Institution.

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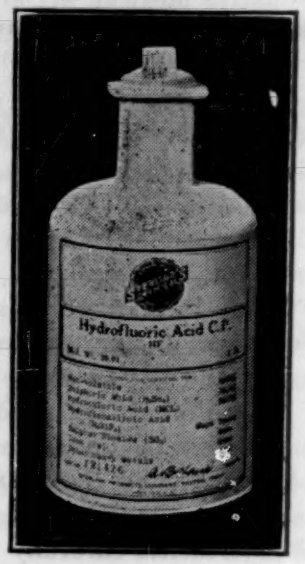

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For hundreds of years naturalists have sought in vain to discover what the young of the blue goose looks like. Even to-day they do not know for certain where it nests. Certain scientists have been skeptical even of the very existence of the bird. Was it not merely an ordinary snow goose in a peculiar stage of plumage?

Each spring the blue geese rise from their winter home in the lower Mississippi valley and fly northward, out of sight and into the blue. Even the Eskimos have never reported finding the nests, eggs or young. For some years it was believed the geese made their way into the unknown vastnesses of Labrador, but the more modern opinion assigns Baffin land as their nesting place.

The remarkable hatching process took place in 1924. Three eggs were obtained from a captive pair in the National Zoological Park. Eggs had been secured on other occasions, but never before had they been hatched successfully. This time, however, officials tried a new scheme. They confided the eggs to the motherly care of a barnyard hen. But she would not have reared them successfully had not man with his scientific knowledge stepped into the picture. The shells seemed too hard for the young to break on their natal day, so a simple procedure was devised by an expert wild duck keeper. Each time the foster-mother left her adopted children for a brief respite, he dampened the egg shells. Thus was reproduced the condition resulting from the mother goose's habit of sprinkling the eggs with her wet feathers.

Man and hen were successful in their novel rearing scheme. Soon three goslings flapped their tiny wings and ornithologists had their first view of baby blue geese.

The Société Nationale d'Acclimation was founded in 1854 by Isadore Geoffrey Saint Hilaire to stimulate the acclimatization of plants and animals to regions in which they are not native.

The medal bears a bas-relief of the society's founder, done by the French artist, Albert Barre. When it is suitably framed it is planned to place the gift in the bird house of the park.

DRAWINGS OF MEXICAN CHILDREN

Out of the mixture of extreme backwardness and forwardness which is said to typify Mexico to-day is struck many an ultramodern note.

The modernist bug has bitten Mexican schools. Principles of teaching, so new that few schools in the United States are experimenting with them, are being used in the public schools of the Federal District and other sections of Mexico as well.

Drawing, for example, is no longer taught as a separate subject following certain rules of art, for the pupils only draw when the necessity arises in the illustration of other subjects of study. And then they are allowed to draw just as they please and without instruction.

This sets free the childish imagination and instinct, according to Juan F. Olaguibel, artist in charge of the section of drawing and manual work under the Ministry of Public Education of Mexico, and as a result the work of the Mexican school children is now remarkable for its great beauty. In this way also any still-existing remnants of native Mexican art are preserved instead of being destroyed by the art of European civilization.

Drawing has become extremely practical in Mexican schools. The children design and decorate their own toys and useful articles for their homes, and this is especially needed in the rural schools, to which this system is being extended. A children's magazine called "Pulgarcito," meaning "Little Thumb," is written and illustrated by the children of the primary schools of the Federal District of Mexico and other states. Business houses allow the children to illustrate their advertisements and so the entire magazine is their own product.

This practicality of drawing in the schools does not mean that the purely artistic nature of the subject is being neglected, Señor Olaguibel said. Although the aim is to remove the pupil from the influence of outsiders, he is nevertheless carefully watched and any real talent that is noted is encouraged.

Not only is drawing now making great progress in the schools and developing the individualities of the pupils, but the subjects that are illustrated are also helped by this system. Facts of geography, history or natural sciences stick much better when they are illustrated in class, and they are better understood and more clearly fixed in the minds of the pupils, Señor Olaguibel has found.

ITEMS

A "yellow peril" among insect pests is taking the place of a "native American" nuisance, according to O. E. Gookins, of Ottawa, Kansas, in an address before the meeting of the American Association of Cereal Chemists. The once troublesome grain weevil, he stated, is becoming extinct, but its decline is accompanied by the increase of the rice weevil. The two insects look very much alike, but the rice weevil can easily be distinguished because it can fly. Mr. Gookins recommended granary fumigation as a cheap and sure method of finishing off the granary weevil for good, and for combating the hordes of the rice weevil.

A large and rare specimen of the Mola mola sun-fish, weighing 1,200 pounds, has just been mounted in the hall of fishes of the North Carolina State Museum. So far as is known only one other specimen of this large primitive fish exists in America. Although the individual preserved here is nine feet long and seven feet broad, jelly-fish was its favorite food consumed through a very small mouth.

The ground squirrel population of Yellowstone National Park, according to a recent estimate, is placed at a million, but the park naturalist, E. J. Sawyer, states that he tried two years ago to get a rough calculation, and that his result was nearer six millions than one. "One can only marvel at the fecundity of the ground squirrel. Red-tailed hawks, Swainson hawks, badgers, minks, weasels and other animals depend largely, and some of them almost wholly, on this rodent for their food. The total number of these depredators certainly runs high in four figures, if not into five."

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SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS AT THE DETROIT MEETING OF THE AMERICAN CHEMICAL SOCIETY

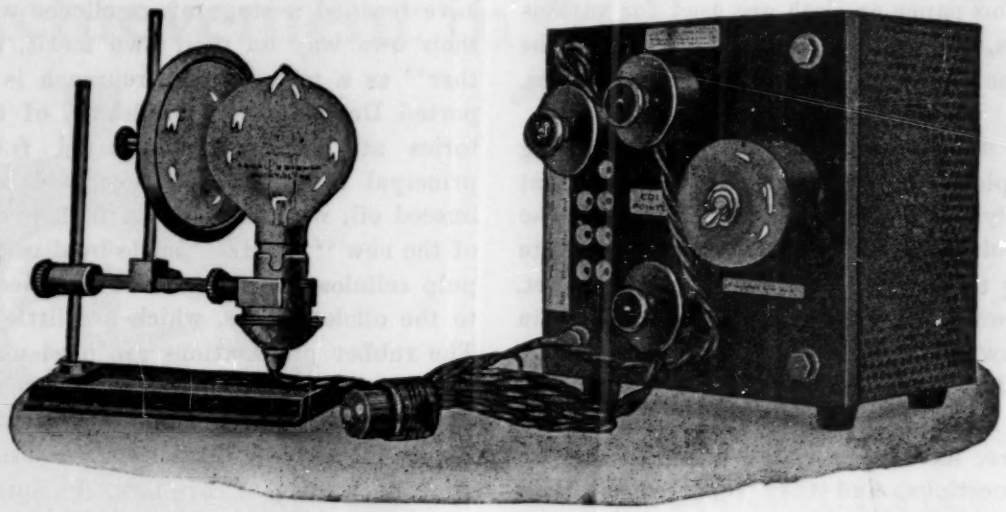
DETROIT is this week the host to an army of 2,000 chemists, members of the American Chemical Society, who are meeting there from September 5 to 10. Every phase of chemistry, from the abstract problems of the teacher and research worker to the practical applications of factory and farm, will be up for discussion. In consideration of Detroit's position in the field of automobile manufacturing an important position on the program will be given to chemical problems connected with that industry. The principal session on the opening day will be devoted to a symposium of the chemical angles of the steels, fabrics, finishes, glass, fuels and lubricants that are concerned in the manufacture and use of motor vehicles. The outstanding event of Wednesday's program was an evening gathering addressed by Dr. George D. Rosengarten, president of the society, and by Dr. Charles F. Kettering, of General Motors. Sectional meetings during the week were concerned with the chemistry of food, drugs, dyes, fuels, gas, oils, paints, rubber, fertilizers and a host of other things of importance in every-day life. Other gatherings discussed chemical education, the history of chemistry, the rôle of chemistry in medicine and surgery and the chemical aspects of life itself. In all, there were eighteen divisions of the society, which heard over 300 papers read.

IN the symposium on "Chemistry's Contribution to Automotive Transportation" H. C. Mougey, of the General Motors Corporation, specified some problems in the field of automobile finishes that still remain to be solved by the chemist. Among these needed inventions are: "A substitute for black baking enamel which will retain the advantages of low cost and ease of application, but which will make the steel more resistant to corrosion under conditions of high humidity, and which will produce a film that holds its luster longer on exposure. Primers and surfacers for lacquer finishes, which will decrease the time of drying without increasing the cost of application. Some method of obtaining the smooth surface of high luster without the cost of the present system depending on hand rubbing and polishing. Professor D. B. Keyes, of the University of Illinois, said that the ideal antifreeze compound for automobile radiators has not yet been reached. The three substances now most widely and successfully employed are alcohol, glycerine and ethylene glycol.

IN the early days, when an auto got stuck in the mud of a country road, the cry was "get a horse." Now it is "get a chemist." The greatest challenge by the motorized world to the modern chemist that has not yet been answered is the challenge of the clay road, said Charles M. Upham, chairman of the highway research board of the National Research Council. Clay, like everything else, will respond to chemical treatment. The chemist must somehow get it to do three things. He must treat it so that it will drain instead of absorbing water and turning into glue. He must cure it of its present disturbing habit of shrinking and swelling according to the amount of water it has taken up. He must increase its ability to bear loads when moist, and improve its workability by road machinery. The chemist who can do this will simply revolutionize road construction. A further contribution which chemists may make to highway improvement is in the manners of asphalt, preventing it from becoming exceedingly hard in winter and soft as putty in summer.

"OLD RUBBER!" Once merely a part of the ragman's chant, these words have now become a powerful economic charm, operating in high-price years to soften the impact on the tire-buyer's pocketbook and in low-price years to save the tire-making industry from disaster. The importance which reclaimed rubber has assumed in the industry, thanks to new chemical processes which have greatly improved its quality, was discussed by William C. Geer, of New Rochelle, N. Y. In one year, Mr. Geer stated, the use of reclaimed rubber saved the consumer $55,297,000. Another recent improvement which has been made in rubber is the addition of chemicals to slow down the rate of oxidation, which does to rubber what rust does to steel. Rubber articles have had their lives thus lengthened by from two to ten years. Mr. Geer doubts both the need and the commercial possibility of artificial rubber. American-grown rubber is in sight, and this, with further improvements in reclaimed rubber, will take care of our needs for a long time to come.

THE single general-purpose emery wheel of the old-fashioned machine shop would be amazed—supposing it had a consciousness—if it could come back and see the family of abrasive machinery that has taken its place in the modern monster automobile factories. Not only have the new grinders new shapes and uses, but they are made of new materials, born of the electric furnace. Dr. Lowell H. Milligan, of Worcester, Mass., told his colleagues of the importance of abrasives in literally grinding out automobiles. It has been said that a Ford manufactured by former methods would cost as much as a Rolls Royce does now, were it not for grinding. In 1904 there was not one grinding machine in the automobile industry. To-day there are 68,000. Countless parts of an automobile are finished by grinding. The chemists and metallurgists have been continually making tougher and harder steels which can not be satisfactorily machined, but must be shaped by grinding. Abrasives are of service not alone as grinding wheels. Loose abrasives are used, suspended in grease or water, for grinding valves, for lapping piston pins and rings, crankshaft pins and bearings, and for sur-



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How great is the danger of carbon monoxide poisoning to which garage employes are exposed? We read frequent accounts in the daily news about automobile owners who have committed involuntary suicide in their small private garages by running the engines when the doors are shut. Yet mechanicians work all day behind closed doors in large garages. How much of an industrial hazard are they exposed to? Dr. S. H. Katz, of the U. S. Bureau of Mines, and Dr. H. W. Frevert, of the U. S. Department of Agriculture, have been endeavoring to find an answer to these questions, and they reported on their work. The two investigators collected samples of the air from a large government garage in Washington and from a large commercial garage in Pittsburgh, and subjected them to chemical analysis. They found that the working conditions in the government garage, so far as the poisonous gas was concerned, were better than those in the commercial establishment. During the regular working day the concentration in the government garage never exceeded one part of carbon monoxide in ten thousand parts of air, while in the Pittsburgh shop the maximum was two thirds again as much, or 1.64 parts in 10,000. In neither establishment did the concentration reach the danger point, though during one hour the carbon monoxide in the Pittsburgh garage attained a "bad eminence" of 4.33 parts per 10,000 of air. This, it was stated, is enough to cause headache in some men. The report adds, however, that the investigations were conducted under only average working conditions. In very cold winter weather, when the garage doors are likely to be kept more tightly closed, conditions may become more serious.

THE production of artificial rubber is apparently brought a step nearer by researches made at the University of Notre Dame reported to the American Chemical Society by the Reverend J. A. Nieuwland. Working in association with Daly and Sister M. Florentine he has found that a ninety per cent. yield of ethylene chloride can be obtained by passing ethylene and chlorine gases into antimony pentachloride. The product can be readily converted into vinyl chloride by alcoholic potash. This chemical reaction will seem unintelligible and unimportant to the general reader, but yet it may have a bearing on one of the most exciting commercial controversies of the day. For Plotnikoff proved in 1922 that vinyl chloride could be converted into rubber by the action of ultraviolet rays from an electric light. The electricity may come from water-power, which may also make calcium carbide of coal and lime. Adding water to the carbide generates acetylene gas, which is easily made into ethylene. So the chain is complete from the waterfall to the rubber tire. But it is very questionable if rubber can be made in a factory as cheaply as it can be grown in a tree.

CLOTH coated with various wear- and weather-resistant materials masqueraded as leather in the early days of the automobile. Now, however, the various coated fabrics have reached a stage of excellence where they can make their own way on their own merit, and "imitation leather" as a term of semi-reproach is no more. Thus reported Dr. Hamilton Bradshaw, of the du Pont laboratories at Wilmington. Coated fabrics are of three principal types. They are coated with preparations of linseed oil, with rubber and with pyroxylin, which is one of the new "plastics" made by dissolving cotton or wood-pulp cellulose in an acid. The linseed oil fabrics belong to the oilcloth class, which are little used in motor cars. The rubber preparations are used mainly in top fabrics, for both open and closed cars. In the latter class they have wholly replaced the old solid, rattly tops of wood or metal. Pyroxylin fabrics are almost universally used as upholstery in open cars now, the speaker declared. Over ninety per cent. of such cars turned out last year were upholstered in this type of leather replacement. The strange part of it is, that now the coated fabric does not need to imitate leather it has reached the point where it can fool even an expert. Dr. Bradshaw told of examining a car that was finished partly in real leather and partly in grained coated fabric. Only when the leather and fabric were loosened and their backs examined was he able to tell them apart.

ETHYLENE, one of the ingredients of common illuminating gas, is working a revolution in the fruit and vegetable industries. Poisonous to plants when present in high concentrations, in small quantities it acts as a stimulant, and advantage is being taken of this recently discovered fact. Dr. F. E. Denny, of the Boyce Thompson Institute, Yonkers, N. Y., discussed fruit ripening by gas attack. It had long been known that when the rooms where citrus fruits were stored were heated with kerosene stoves the usual time required for changing the green rind to the desired golden hue was reduced to about one fourth. Dr. Denny's experiments in 1922–1923 indicated that the active agent in the combustion gases was ethylene. Now this gas is used instead of the old oil stove in the treatment of hundreds of carloads of oranges and lemons, thus avoiding fire risk and smoky odor. Surprisingly low concentrations of ethylene added to the air surrounding the fruit are able to bring about hastened coloration. If precautions are taken to prevent the loss of ethylene by diffusion, the process is successful with one part ethylene to 10,000 parts of air, one part in 100,000 or even one part in 1,000,000. In practical operation a somewhat higher original concentration is used in order to take care of losses of gas, but it has not been necessary to use a greater concentration than about one cubic foot of ethylene to about 5,000 cubic feet of air.

THE search to find the perfect disinfectant was described by Dr. Herbert C. Hamilton, research chemist for a large pharmaceutical firm. The weakness inherent in most chemical germicides lies in the fact that the ones that kill germs effectively also injure the surrounding

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body tissue. Exceptions to this general rule are the class of chemicals known as colloids, of which argyrol is an example, and certain of the aniline dyes which seem to have a selective action. This condition does not necessarily imply that the germicide is selective in the sense of attacking the microorganisms in preference to the tissue of the body but more probably to specific differences in the resistance of the organisms.

THE product of the cow has one advantage over the food traditionally supposed to be best for babies. Cow's milk is more effective as a rickets preventive than human milk, according to Dr. Icie G. Macy, director of nutrition research at the Merrill-Palmer School. Thirty cubic centimeters of cow's milk daily for a week produced a marked healing of the bone lesions in young rats with rickets, while the administration of 40 cubic centimeters of human milk daily had no effect on the condition of the rickets.

TWO active principles of great potency in their effect upon the human body have been extracted from the pituitary body by Oliver Kamm and associate investigators of Detroit. The pituitary body is a gland about the size of a pea situated at the base of the brain. It has long been known that the gland secreted certain substances into the blood which had a powerful influence on the rate of bodily growth and the activity of various organs, but since these compounds could not be separated from one another and obtained in pure form their use in medicine was uncertain and restricted. Now, however, two of the compounds from the back lobe of the gland have been isolated and can be analyzed in the chemical laboratory. One of them injected into the blood greatly increases the blood pressure and the other causes strong contractions of the uterus.

THE word chemistry and the names of such chemical materials as toilet articles, perfumes, dyes, textile fibers, precious stones and metals have been traced back to an Aryan source by Dr. W. R. Kokatnur, consulting chemist of New York City. He cited hieroglyphic records as well as archeological and ethnological evidence to support his conclusions concerning the origin of chemical terms. The isolation of metallic mercury dates back further than many historians have believed, according to Dr. Earle R. Caley. Apparently the only compound of mercury known to the ancients was the sulphide. This was used as a pigment and early Roman writers have left accounts of a chemical test to detect its adulteration.

RALPH WALDO EMERSON, the great essayist, kept in close touch with the development of chemistry from the time he was a boy of seventeen until his old age, Dr. Charles Albert Browne reported. Emerson's journals and essays are filled with chemical references, said Dr. Browne, while he drew freely upon his knowledge of this science for many of his most striking analogies and comparisons.

ITEMS

POSITIVE proof that beauty is only skin deep was recently shown by Roger B. Corbett, of Rhode Island State College, who took four varieties of apples, peeled them, and cut them into cubes which he placed before eleven different men, ranging from bankers and professional men to farmers and mechanics. The apple that was rated first when seen whole, shining in its brilliant red skin, ranked last in taste. In the taste test the McIntosh won first place, the Baldwin second, the Rhode Island Greening third and the Rome Beauty last. The Rome Beauty, a dessert apple that is a favorite in stores and on fruit stands, when peeled was found least tasty. In another test to determine the distribution and consumption of apples, 4,000 questionnaires were mailed to Providence families. It was found that 46.7 per cent. are eaten raw, 48.5 per cent. cooked, either in pies, sauce or general baking, while apples used in salad constituted 4.8 per cent.

TWELVE million dollars for state parks is the ambitious program projected for California by a number of civic organizations of that state. Bills now before the legislature provide for a bond issue of $6,000,000 to be matched by an equal amount from private gifts and other outside sources. A considerable part of the areas expected to be set aside under the new program will be in the famous California redwoods country. These trees, closely related to the famous "big-trees," constitute a remnant of a once world-wide distribution of tree giants that flourished before the last great ice age. Individual trees now standing have been in existence since long before the beginning of the Christian era. For historic and scientific interest as well as for the sake of their scenic beauty a strong and fairly successful effort has been going on for some years, to save a part of the redwood forests from cutting.

PLANS for a large reflecting telescope, with a concave mirror twelve feet or more in diameter, and to be the largest in the world, have been abandoned, according to an announcement in *Popular Astronomy*. The telescope was to be made in France, and financed by a wealthy Hindu by the name of Dina. Professor G. W. Ritchey, American astronomer, who designed the great 100-inch telescope of the Mt. Wilson Observatory, now the world's largest, has been experimenting with a new method of making large mirrors at the Paris Observatory, in France. The new method consists in making the great glass mirror with a cellular construction, out of smaller pieces of glass, instead of a solid piece. One of the chief things which has prevented the making of large telescope mirrors has been the difficulty of making the great glass discs at the start. Professor Ritchey has already made mirrors of 36 inches' and 60 inches' diameter. When recently visited in Paris, he said that one of 30 feet was not impossible. However, Dina's plans have been abandoned, but the Paris Observatory has authorized Professor Ritchey to make two mirrors of 20-inch diameter, one by the old method, and one by the new, so that their relative merits may be tested.

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SCIENCE NEWS

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BERYLLIUM

AIRSHIP frames and light-weight pistons may soon be made from beryllium or its alloys, and this hitherto unknown metal may soon achieve the household familiarity that aluminum has won during the last two or three decades.

Beryllium is a metal about a third lighter than aluminum, but is very much harder, scratching glass easily like hard steel. According to H. S. Cooper, industrial chemist of Cleveland, who has been conducting extensive experiments, it is one of the most remarkable of all metals in its elasticity. It is over four times as elastic as aluminum, and 25 per cent. more elastic than steel. And while aluminum corrodes easily on contact with salt-water, beryllium shows very high resistance to this as well as to other metal-destroying liquids and fumes. It is light gray in color, and takes a polish like that of high grade steel.

It is chemically related to aluminum, and easily forms alloys with it. One of these, consisting of 70 per cent. beryllium and 30 per cent. aluminum, is one fifth lighter than aluminum, far more resistant to corrosion and in tensile strength far exceeds duralumin.

One quality which Dr. Cooper points out may render beryllium especially valuable to the automobile industry. It expands under the influence of heat at about the same rate as cast-iron. Thus when used for light pistons inside the iron cylinders of automobile engines it will present far less engineering difficulty than do the present types of light pistons, which expand at a rate different from that of iron.

Beryllium ores are found abundantly both in this country and abroad. At present they are hauled out of feldspar mines in New England by hundreds of tons, but are dumped away as waste. The commonest type of ore is known as beryl, polished crystals of which are sometimes worn as semi-precious stones.

Although so new industrially that it can not properly be said to have been born yet, scientifically beryllium is an old story. It has been known to chemists for 130 years; Vauquelin, a Frenchman, first indicated its existence in 1797. But until recently it has remained merely a museum curiosity and a laboratory material, because it is so refractory that the cost of getting it in anything like a pure state has been prohibitive. But now that the cost of manufacture promises to be materially reduced by a new electrolytic process, it is probable that it will appear on the market in quantity within a few years.

LIQUID FUEL FROM COAL

THE key to the conversion of water-gas made from coal into petroleum-like liquid fuels, jealously guarded by all the chemists who have discovered it, is being sought by chemists of the U. S. Bureau of Mines. And in its main principles at least it has been discovered. Three Bureau of Mines chemists, David W. Smith, J. D. Davis and D. A. Reynolds, reported their findings to the American Chemical Society meeting at Detroit, which will be published in detail in an early issue of *Industrial and Engineering Chemistry*.

The stimulus that started them to work was the secretiveness of the oil-making chemists, particularly the Germans, about the catalysts they used in their processes. A catalyst has been defined as a chemical go-between or matchmaker; it is something that promotes the combination of other elements or compounds, without itself becoming a part of the combination. Nobody knows much about the way catalysts do this, but the fact that they do is exploited in many industrial chemical processes, such as the synthetic production of ammonia from the nitrogen of the air.

The foreign chemists, in their publications and at scientific gatherings, would state frankly enough the proportions of hydrogen and carbon monoxid they used, the temperatures and pressures they employed, and all other details, but would merely say, "The gas was then passed over a catalyst," when it came to the crucial point. They never told what the catalyst was, or when they did reveal its constituents they still remained silent regarding their proportions or the important details of their preparation.

The three government chemists have tried six different catalysts, all of them being mixtures of metals in a very finely divided state, exposing a great deal of surface to the action of the gases. The most effective was one made up of metallic cobalt and manganese oxid, with a small amount of metallic copper. This produced from the water-gas a mixture of hydrocarbons, ranging from the simple gaseous forms to those forming a clear, oily liquid.

FISH HATCHERIES OF THE UNITED STATES

WE have become accustomed to billion-dollar Congresses and we are beginning to discuss billionaires. Difficult as it may seem of achievement, we are now stocking our waters annually with billions of fry, fingerling and adult fish. These are the output of Federal, State and private hatcheries. Nearly every state has at least one hatchery, and the Federal government has 70 stations and substations all the way from Afognak, Alaska, to Boothbay Harbor, Maine; from Duluth, Minn., to San Marcos, Texas.

In 1926 the output of the U. S. Bureau of Fisheries fish-cultural stations and of the rescue fields bordering the Mississippi aggregated 5,232,000,000 fish and eggs, according to a recent report by Glen C. Leach. The forty-four species propagated include nearly every important food and game fish in our waters. Because of the increased demand for fish of the fingerling sizes, the output was increased more than 100 per cent., total-

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Fish-culture is becoming more and more an exact science. The modern fish-culturist talks in terms of pond fertilization, the use of forage fish for food for the game fishes, use of foods rich in vitamins, and the free use of the thermometer to prevent his brood from being subjected to too sudden changes in temperature.—*Lewis Radcliffe.*

X-RAYS AND EVOLUTION

How X-rays in heavy doses have been used to speed up the process of evolution over one hundred and fifty times was told before the Fifth International Genetics Congress, meeting in Berlin, by Professor H. J. Muller, of the University of Texas. At the same time, Professor Muller suggested caution to physicians in the use of X-ray therapy, stating that the reproductive cells of human beings are probably just as susceptible to the influence of these rays as were those of his experimental insects, and that heavy rayings of the genital tract might have lamentable results in a later generation. Ordinary uses of the X-rays, it might be added, are not to be regarded as dangerous.

Earlier experiments by other workers in the same field had produced some results, but these were of an equivocal nature. Professor Muller, however, decided to try again, with heavier rayings. He used the familiar little fruit-fly, well known to both geneticists and housewives, because it breeds rapidly and costs little to keep.

Raying these in large numbers, he waited for results. The first generation were normal, like their parents, but among the second generation, the grandchildren, were numerous mutations or "sports," with abnormal wings, eyes and other organs. These were the same kind of things geneticists have been observing for many years in their studies of evolution, but they were produced over one hundred and fifty times as frequently as they are accustomed to occur naturally.

The theory of this remarkable effect of the X-rays on animal heredity is that their energy in some way affected the "genes," or hereditary units, that are bound to the chromosomes, which are special bits of living substance in the reproductive cells that always pass over in the same way from parent to offspring. "The X-rays hit these genes like a charge of shot hitting a pile of pebbles, and had much the same kind of effect on them," was the phrase of Professor Muller.

His warning against possible ill effects among the grandchildren of parents recklessly exposing themselves to heavy X-ray treatment without good cause is based on the fact that the chromosomes and genes in human cells are very much like those in the cells of the lowly fly; and what happened to the insect might easily happen to a man or woman.

CLADOCERA

An instance of evolution in a laboratory bottle, with a small aquatic animal producing offspring that can thrive only at abnormally high temperatures, was described before the congress by Dr. A. M. Banta and T. R. Wood, of the Carnegie Institution of Washington.

In conducting a series of experiments at the Station for Experimental Evolution at Cold Spring Harbor, N. Y., in which huge numbers of a minute water animal known as Cladocera had to be reared, they noticed that the brood of one of the animals were not doing very well, and they tried putting the bottle in which they were growing into a warmer place. At once the little creatures began to thrive and multiply. Further observations brought out the fact that the new race demanded for its best growth a water temperature considerably above that which its parent species found most suitable for its life processes, and this preference for being "always in hot water" was handed down from generation to generation.

Dr. Banta suggests that the peculiar animals and plants that live in hot springs, some of them at temperatures near the boiling-point, may have originted in this fashion. "Mutations such as the one we have observed in the laboratory must also occur once in a while in nature," he says. "But under ordinary circumstances, with no warm water handy for them to live in, the new strain will die out. However, if the mutation should happen to occur in the run-off stream from a geyser or hot spring, the warmth-loving animals could swim to a place where the temperature would suit them, and there survive and multiply."

LOCUST PODS FOR FODDER

FODDER for stock will be harvested from the farmer's fencerow and woodlot trees, as well as timber for posts and other uses, according to a plan now being promoted by *The Journal of Heredity.* Honey locust pods are eaten eagerly by hogs and cattle, which find them tasty and nutritious, and the editors of the magazine are offering $50 in prizes for the tree with the biggest and best yield of pods. They invite any one who owns an exceptional locust tree to write them for particulars of the competition.

Some of the elongated fruits of the honey locust tree are a foot or more from tip to tip, and the small, hard seeds are embedded in a matrix of sweet, gelatinous substance. The pods are somewhat similar to those of the carob of the eastern Mediterranean countries, which has been used for centuries as stock food in its native land and is planted to some extent in our own Southwest. The carob will even do, at a pinch, for human food. When the prodigal son found himself reduced to "the

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husks that the swine did eat,'' it was these thick, sweetish carob pods he was eating; and under the name of ''St. John's bread'' they are regarded by some as having been the frugal diet of John the Baptist.

Some experiments already in progress indicate that the native honey locust may be a fair competitor for the carob as a fodder producer. The present governor of Georgia, Lamartine Hardman, likes to experiment with new stunts in scientific farming, and he reports that locust pods have proved very satisfactory, both when raked up and fed in the barn and when left to lie for the animals to pick up for themselves.

ASIATIC CHOLERA

ASIATIC cholera, which is reported to be decimating the troops of the Northern army in the Nanking district of China, is an example of a highly fatal disease that has spread through the world by the increasing facility of modern travel. It has existed since very early times around the mouth of the Ganges but up to the time of the British occupation was not known outside India.

The first recorded excursion of this dangerous infection beyond its native haunts took place in 1816. It traveled slowly in those days of sailing vessels but managed to extend its range to the rest of Asia and to Africa. In 1826 it broke loose again, reaching as far as Europe and America. Twenty years later it spread to the uttermost parts of the earth. It followed the forty-niners across the American continent during the gold rush. In France alone it killed 150,000 people. It has flared up in world-wide epidemics three times since. The last, which occurred in 1902, had its start from the gathering of some 400,000 pilgrims at Mecca.

The cholera bacillus is carried in drinking water from regions where the disease is prevalent. Infection only takes place by swallowing the bacillus, much as typhoid fever infection is transmitted. This means that Asiatic cholera can be brought under control by sanitary measures and for this reason has never gained a serious foothold in advanced countries during recent years.

Vaccination is an important adjunct to sanitation in the prevention of this disease, particularly when epidemics break out in time of war. When, however, medical and sanitary measures are not available, as in many sections of China at the present time, fatalities inevitably run exceedingly high.

TUBERCULOSIS VACCINE FOR CATTLE

THE preventive tuberculosis vaccine that has been developed by Dr. Albert Calmette, director of the Pasteur Institute at Paris, is about to be tried out on herds of dairy cattle through the cooperation of the British veterinary ministry of health.

The vaccine is known as BCG, from the names of its discoverers, Dr. Calmette and Dr. M. Guerin, of the Pasteur Institute at Lille. It consists of an attenuated strain of bovine tubercle bacilli that have, after years of cultivation on beef bile medium, somewhere in the succeeding generations lost their virulence, though they still apparently retain their power to confer immunity.

The vaccine will be used in selected herds in which tuberculosis is known to be present. All calves will be vaccinated within two weeks after they are born. The operation will be repeated every twelve months, over a period of five years. By that time most of the older and tuberculous cows will have been worked out of the herds. At the end of this period the herds will, it is expected, consist largely of adults that have been kept free from infection by vaccination.

Members of the staff of the health ministry will supervise the vaccinations to check up on the efficacy of this new method of attacking tuberculosis in cattle.

ITEMS

THE members of one of the French athletic teams are regularly using ultra-violet ray baths during training, having been convinced of their value in toning up the system. England as well as France is following the example of America and Germany in the use of ultra-violet rays for preventive and curative medical purposes. In the British Parliament a bill is under consideration making it obligatory for light baths as well as water baths to be installed in mines, freely available for every miner who has been deprived of sunlight for six hours a day. An enterprising municipality is fitting out ordinary public bath-houses with ''artificial sunlight.''

THE old adage, ''What is one man's meat is another's poison,'' has been well illustrated by the effects of ultra-violet rays on the sugar solutions in which yeast cultures are grown. Experiments performed by Drs. J. W. Woodrow, A. C. Bailey and E. I. Fulmer, of the Iowa State College, show that if the flasks of nutrient liquid in which the minute plants are subsequently to be grown are exposed for a number of hours to the invisible radiations, they become definitely poisonous to the yeast cells, markedly decreasing their rate of growth. This is completely contrary to the results obtained by irradiating the food of animals, which have been shown to generate beneficial vitamins under such treatment.

COD-LIVER oil and yeast, popular medicines for human beings, are proving to be almost as beneficial when fed to fish. Such is the statement of Dr. Lewis Radcliffe, of the Fisheries Bureau of the Commerce Department. So firm is the faith of the Fisheries Bureau in the efficacy of the two human medicines that an entire bureau hatchery at Holden, Vermont, has been turned over to the fish doctor, H. S. Davis, for experimentation. Healthy fish as well as sick ones are responding favorably to the unusual vitamin treatment. Trout, in particular, show remarkable development when fed cod-liver oil. The usual procedure is to subject two broods of trout to a 30- to 50-day period of experimentation. Other conditions being equal, one brood is fed yeast or cod-liver oil, and the other given its usual feed. Results are carefully tabulated. Experiments already made have shown decided improvement as to increased growth, general vigor and loss by mortality. The cod-liver oil or yeast is added to the feed in powdered form.

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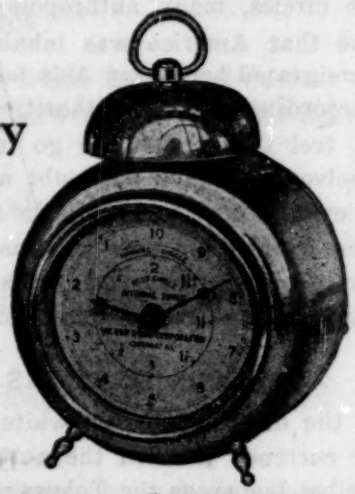

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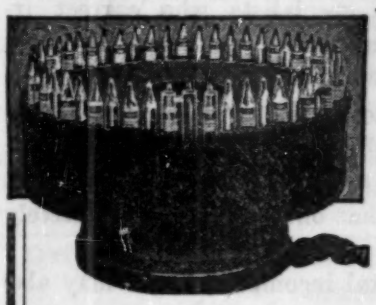

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SCIENCE NEWS

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RACE MIXTURE

FAST transportation that has carried civilized peoples into the remote corners of the earth is bringing about problems of race mixture such as have never existed before in the history of mankind. The potential dangers of European stock settling among primitive races were pointed out by Dr. Charles B. Davenport, of the Genetics Laboratory of the Carnegie Institution of Washington, at the International Congress of Anthropologists in session at Amsterdam.

It is not strange, Dr. Davenport stated, that statesmen, biologists and eugenists are asking what the consequences of such race crossing are likely to be. The question is raised whether it should be welcomed as tending to produce higher types or whether steps should be taken to prevent immigration to any country as a menace to its culture.

Each race that has persisted a long time in a distinct environment, the eugenics authority explained, has certain adaptations to that environment. In the mixture of races now taking place there are combinations of conditions which sometimes lead to disharmony from the conflict of developmental tendencies.

"Thus," he continued, "in America we have a union of races, characterized by large teeth in large jaws, with others having small teeth in small jaws. It has been suggested by orthodontists, specialists who correct irregular teeth, that a combination of an hereditary tendency to large teeth, combined with hereditary small jaws produces the crowding of teeth which has made orthodontia so important a branch of medicine in the United States. Such crowded jaws are in striking contrast with the uniform dental arcades that one sees in comparatively unmixed, primitive peoples.

"Mental and temperamental incompatibilities may also arise, as we see in the mulattoes of North America, which combine something of a white man's intelligence and ambition with an insufficient intelligence to realize that ambition. This leads in the hybrid to dissatisfaction and a feeling that he is not getting a fair deal."

The mixed progeny of the Chinese and the Hawaiians in the Hawaiian Islands stand first among all hybrids in industry and self support, in Dr. Davenport's estimation. They have the intelligence of the Chinese with the well-stabilized, docile and patient temperament of the Polynesian. Another comparatively successful cross is among the Dutch settlers and the natives of Java and Sumatra. These hybrids are often possessed of great physical beauty and high intelligence.

It is difficult to arrive at a dispassionate scientific analysis of the consequences of human hybridity, Dr. Davenport stated, because the subject is one that arouses emotional bias. The result of race crossing, he affirmed, depends on the particular nature of the cross.

"In the absence of any uniform rule as to consequences of race crossing it is well to discourage it, except in those cases where, as in the Hawaiian-Chinese cross, it clearly produces superior progeny. The Negro-white and Filipino-European crosses seem, on the whole, socially inferior to the parent races."

EVIDENCES OF EARLY MAN IN AMERICA

CLAIMS that primitive man inhabited America at a time vastly earlier than hitherto supposed have received substantiation through the visit of Dr. O. P. Hay, of the U. S. National Museum, Smithsonian Institution, to the gravel pits at Frederick, Okla., where were recently discovered well-made flint arrowheads and other artifacts in association with skeletons of animals that lived during the early part of the glacial epoch.

Acceptance of such antiquity for man in America will not only upset the prevailing notions as to human history in the western hemisphere but will date ancient man in America earlier than the famed Neanderthal and Cro-Magnon men of Europe.

The new evidences of early man in America were unearthed, studied and reported by J. D. Figgins and Harold J. Cook, of the Museum of Natural History, Denver. Dr. Hay's trip was made to inspect the site and the circumstances surrounding the excavations. Dr. Hay is regarded as the leading authority on the animals of the geological period, called the Pleistocene, which just preceded the present. The question of the existence of early man in America has long been one of controversy in scientific circles, many anthropologists being unwilling to believe that America was inhabited before the Indians who emigrated here from Asia not more than 25,000 years ago according to some authorities.

"I feel that those who go to Frederick and see for themselves will have no doubt as to the authenticity of these evidences of early man in America," Dr. Hay said. "Those who believe that man has existed on this continent for only a few thousand years should investigate this case and give us their explanation of it."

SHELLS USED AS CURRENCY

IN the days before the white man with his gold and silver currency invaded the northern part of California, the tribes known as the Tolowa, Karok, Yurok and Hupa had a well-defined monetary system established, the principal medium of exchange being the peculiarly shaped, long, white, curving dentalium or tusk shells.

Recently there came to the Museum of the American-Indian Heye Foundation several strings of this shell money. In the period of American occupancy of California immediately after the gold rush and up until the late 80's, this odd currency circulated among the Indians and whites as well. To-day, although new, undecorated shells of the ordinary or "woman's dentalia" are quite common, the longer, quaintly ornamented shells are becoming scarcer and scarcer and it is only when some aged Indian, pressed by the high cost of living and impor-

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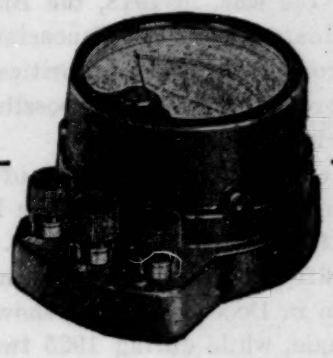

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SEASHORE ANIMALS OF THE PACIFIC COAST. Myrtle E. Johnson and Harry J. Snook. 632 pp. $7.50.

A history of the life and habits of the more common animals found along the shores of our western coast. Although intended for the ordinary reader, the authors have taken great care to make the book scientifically accurate.

THE ORIGIN OF SPECIES. Charles Darwin. Edited by Edmund B. Wilson. 539 pp.

A reprint of the sixth edition. The book is too well-known to need any description, but there is added to this new edition an introduction of twenty-nine pages by Professor Wilson, which discusses the work and methods of Charles Darwin.

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tuned by his younger and more modern relatives, reluctantly parts with his symbol of wealth, that the old-time money comes to light.

In primitive times, the dentalium shells used as money were from one and seven eighths to two and one half inches in length. The longest shells were valued at $5 each, the shortest between twenty-five and fifty cents. The shells were strung on leather or sinew cords, eleven to fifteen shells being the general length of the strings. The eleven-shell string was the most valuable and allowing for fluctuation and method of measurements was roughly valued at $50.

In measuring an individual shell, the units of measure were the fingers. The longest shells were placed on the little finger and a shell to be of the utmost value should reach from the farther crease of the little finger to the fold of the palm below. Other sizes were matched against the middle finger. In some cases men had their forearms tattooed with a series of marks whereby whole strings could be measured.

Currency of this sort was in demand and the owners treasured it above all else. The majority of such odd "coins" were often profusely decorated with incised lines or wrapped with thin spirals of snake skin. Occasionally woodpecker scalps would be tied in small tufts to the precious things. In order to keep the "otlwetsik" or "human beings their dentalium," as it was called by the Yuroks, safe from harm, the California financiers carried their wealth in purses made of elk horn, hollowed out and decorated with incised geometric designs.

Strangely enough, the tribes that prized the shell currency the most highly were not the ones who took it from the ocean bed. The dentalia in olden times were fished from sand bars off the mouths of northern rivers by Indians inhabiting Vancouver Island, the northern coast of Oregon and British Columbia. The shells were traded southward and after passing through several hands finally arrived in the California country, where they were eagerly received.

With such wealth the tribal magnates bought houses and canoes, wives and clothing, furs, obsidian blades, woodpecker scalps, tobacco, etc. The obsidian blades, huge things often two and a half feet long and five inches and more in width, of both black and red obsidian, and the brilliant red top knots of the common woodpecker were also deemed units of wealth. Even to-day these objects are held above all other items of native manufacture or use. The albino or white deer skin is likewise considered a rare treasure and when a man can display such a skin in the "White Deerskin" dance along with one or more obsidian blades and a headband of red-headed woodpecker scalps, he is indeed a plutocrat.

THE EUROPEAN BISON

THE wisent, European cousin of the American buffalo or bison, is to-day in far greater danger of being exterminated than the bison was a generation ago, after the great slaughter of the eighties. Before the war they were reduced to two moderate-sized herds in Russia and scattered smaller groups elsewhere; and counts taken since then have shown that the great cataclysm almost destroyed the species.

Before the war the wisent was found in the great forest of Bialowies, Lithuania, then a hunting preserve of the Czar. In 1914 there were here about 800 animals, which had been so carefully attended that they had practically ceased to be wild.

The second herd, of about 700 head, lived in the Kuban district of Caucasia, in great preserves belonging to the Russian Crown. These were still fairly wild and had not been pampered, as those in Bialowies had been.

Lastly, there were some seventy animals on the estates of Prince Pless in Upper Silesia, then a part of Prussia. There were also scattered all over Europe perhaps 75 more, in zoological gardens and on private estates.

By the end of the war, in 1918, the Bialowies wisents had been exterminated. Of the Caucasian herd, according to reports from the Soviet authorities, about 25 are left, which are protected as far as possible. The Pless herd has been reduced to 3 head.

In order to preserve what was left of the wisent in Europe, the International Society for the Preservation of the Wisent was founded in August, 1923. At that time there were only fifty-six wisent left in Europe.

A census, taken in December, 1925, showed 69 head, 36 male and 33 female, while during 1925 twelve calves had been born.

The year 1926 was the most unfortunate for the wisent. The herd of Herr von Beyme, at Scharbow, Mecklenburg, six animals, fell victims to hoof-and-mouth disease. There was a decrease in the number of calves born, eight as compared with twelve in 1925; and finally records and careful examination have shown that the whole herd of wisent in Hungary and several of those in Sweden and Copenhagen are not pure blooded. Thirteen animals, six bulls and seven cows, must be therefore removed from the registry of pure stock.

The final result is that there are 21 bulls, 20 cows and 11 calves born since January, 1925, a total of 27 bulls and 25 cows, or 52 animals, as against 56 at the time of the foundation of the Wisent Society in 1923.

The Soviet Government has been exploring the 965 square miles of the Kuban region in Caucasia and investigating the status of the wisent there, but so far no report has been made available.

THE RED WOLF OF TEXAS

THE red wolf of Texas, despoiler extraordinary of sheep, goats and poultry, has caused so many thousands of dollars' worth of damage during the past eight months, that government wolf experts are conducting a ruthless warfare against him.

Central Texas counties in particular are bending their efforts towards quick elimination of the pest. In Parker County alone, it is estimated that annually the red wolf destroys from $25,000 to $35,000 worth of animals. The chamber of commerce has found it necessary to put up dollar for dollar with the people in the rural districts, employing two government hunters, who, in the eight-month period, managed to kill more than a hundred wolves.

Like his cousin, the notorious gray wolf of the western plains, expert killer of calves, which has been virtually stamped out in the West, the red wolf is primarily a lone

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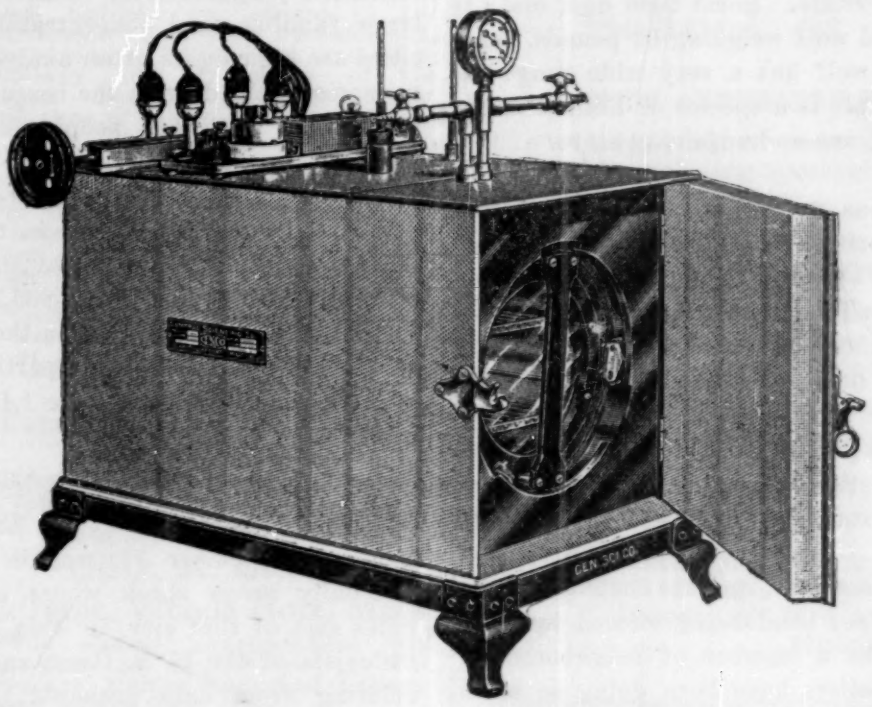

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despoiler. His habit is to venture forth at night, sweeping down upon farm and ranch, killing his prey and then hastening to his out-of-the-way retreat to sleep away his food debauch.

The Texas red wolf ranges in weight from 30 to 60 pounds, while the gray wolf, known in Texas as the lobo or timber wolf, ranges between 75 and 100 pounds. However, larger individuals have been caught, according to C. R. Landon, leader of government predatory animal control in the Lone Star State. Some time ago, one of his men caught a giant red wolf weighing 63 pounds, near Llano. While the gray wolf has a very wide range in North America, the red wolf is a species of limited habitat, being found only in Texas and adjoining states of the Southwest.

The State of Texas has no red wolf bounty at the present time. The authorities learned a lesson from experiences of other western states in trying to eliminate the gray wolf. They discovered that while the bounty method had obvious advantages, there was a tendency for certain unscrupulous hunters to bring animals across the state borders. Another unfair and harmful practice of the "bounty wolfers" was to permit the females to live, with the result that often in the long run, far from being eliminated in a given state, the wolves increased in number.

In certain instances, however, private bounties have been created, a flat rate per head being offered by some clubs and individuals. In a number of neighborhoods, scattered individual despoilers have been doing so much damage that bounties as high as $150 to $300 are being offered.

ITEMS

LEATHER books need pure air just as much as humans do. Recent tests by the U. S. Bureau of Chemistry, analyzing a large number of worn leather bookbindings, show that leather books deteriorate when exposed to harmful sulphurous and acidic impurities. Backs of leather books deteriorate quicker than the sides because ordinarily they are more exposed to light and impure air, the tests reveal. To prolong the life of treasured leather bindings, steps should be taken to prevent their deterioration through the absorption of atmospheric impurities. Certain coatings and finishes, notably neat's foot and castor oil, are stated to be excellent for the purpose.

WHEN Dr. A. L. Quaintance, associate chief of the U. S. Bureau of Entomology, accompanied by several fellow scientists, visited the headquarters of the Japanese beetle warfare at Riverton, N. J., recently, the pests, in addition to denuding orchards of fruit and leaves alike, were feeding busily on the silk of young sweet corn. This type of injury, scientists fear, may indicate serious damage to the country's corn crop if the pest can not be headed off from the corn belt of the Middle West.

AT the Fifth International Genetics Congress in Berlin, Professor William M. Eyster, of Bucknell University, told how his studies of variegations, or contrasting colors appearing in the leaves and flowers of plants, led him to the adoption of the genomere hypothesis. The standard concept, that genes were indivisible hereditary units, could not account for these stripings and spottings, and the only thing to do was to think of the genes as cut up into sub-units, which usually hang tightly together, but which on occasion can come apart and rearrange themselves. When they do this, they form a sort of genetical mosaic, which expresses itself in the mosaic appearance of the plant itself.

STRONG preponderance of women, the disappearance of large families, and concentration of the population in cities are high lights of an analysis, just published, of information gained from the census of England and Wales for 1921. With 649 people for every square mile of territory the population is more dense than in any other country for which statistics are available. Nearly 80 per cent. of the people live in towns and about half of these in 46 cities of over 100,000. Of the 17,178,050 persons gainfully employed, 5,065,332 were women. The surplus of women over men in the two countries amounted to 1,700,000 and showed up particularly in the age group of 30 to 35 where there were 1,470 unmarried women for every 1,000 unmarried men.

THE slight earthquake reported as having been felt in Constantinople at 5:16 P. M., Eastern Standard Time, on Sunday, September 11, was in reality the edge of an unusually severe shock whose epicenter was about 150 miles east of that city, in Asia Minor, according to seismologists of the U. S. Coast and Geodetic Survey. Calculating from data gathered by Science Service from six American and Canadian observatories, the government scientists located the point of greatest disturbance as lying close to the margin of an eastern Mediterranean area known to be very frequently shaken by earthquakes. The stations furnishing the data were those of the U. S. Coast and Geodetic Survey at Chicago, Tucson and Manila, two Canadian stations at Ottawa and Victoria, and Father Tondorf's instruments at Georgetown University, Washington, D. C.

THE preference of natives of South China for the flavor of raw or half-cooked fish has resulted in wide-spread infection from a parasite known as clonorchis. Scientists from both the orient and the occident at the Peking Union Medical College have tracked down the life history of the parasite and are attempting to work out some sort of curative treatment for its human victims. The clonorchis spends part of its existence in the body of fresh-water fish and the disease it causes is unknown in the regions of North and Central China, where more thorough habits of cooking are the rule, according to Dr. Ernest Carroll Faust, who has been directing the research on this problem. Preparations of antimony have been found helpful in treating some cases but it is not potent enough to kill off the parasites. The aniline dye, gentian violet, has worked very well with animals but has not yet been tried out on people, the investigators state. The really important way of eliminating this disease, they declare, is to train the Chinese *actually* to cook what fish they eat and safeguard from contamination the lakes and pools where fish are bred.

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The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

THE MONIST

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PLANET MERCURY

THE planet Mercury, nearest to the sun of all the members of the solar system, turns once on its axis in eighty-eight days, the same time that it takes to travel once in its orbit around the sun. The result is that it always keeps the same face to the sun, just as the moon always keeps the same part of its surface towards the earth. E. M. Antoniadi, famed planetary observer of the Meudon Observatory, told a Science Service representative of his latest observations, which indicate these facts and confirm the views of Schiaparelli, an Italian astronomer. M. Antoniadi has made his planetary observations with the great 33-inch refracting telescope of the Meudon Observatory. This instrument is the world's third largest, and the largest outside the United States.

In a series of observations during the past summer, most of them made in broad daylight, while Mercury was high in the sky, and not down near the horizon, as it is ordinarily seen with the unaided eye, M. Antoniadi has seen markings on the planet which were previously unnoticed. From these he has detected the period of rotation, or the planet's "day," which turns out to be the same as its "year." As a result of another motion which the astronomer calls libration, however, more than half of the planet's surface is exposed to the sun's rays at one time or another. However, despite the libration, there is a little over three eighths of the surface which is never exposed to the sun's rays, but is perpetually in night. At the sun is on the average only thirty-six million miles from Mercury, as compared with ninety-three million miles from the earth, the part of the opposite side where the sun is almost always directly overhead must be exceedingly hot.

While Mercury is so small that it is generally supposed that it can have no atmosphere, M. Antoniadi thinks it possible that some sort of a veil, perhaps volcanic smoke, may at times cover large areas of the planet. The markings which he has observed, he states, are usually very faint, but sometimes they are remarkably clear, an effect which he attributes to the presence or absence of obscuring matter on Mercury itself. The color of the planet, he says, is yellow orange with a tinge of copper, while the dark areas are gray, like the "seas" or dark areas of the moon.

Somewhat similar is the behavior of the third satellite of Jupiter, one of the four moons of that planet which Galileo discovered in 1610. Last year Professor Joel Stebbins, of the University of Wisconsin, announced results of his studies which showed the brightness of this moon to vary just as often as it revolved around its parent planet. This was attributed to the fact that one side of the moon is brighter than the other and that it always keeps the same face to Jupiter. By means of spots which he has observed on the satellite, M. Antoniadi has confirmed Professor Stebbins's conclusions by direct observation.

As the earth, with its astronomers, is entirely outside the Jupiter system of moons, from our point of vantage all sides of the satellite may be seen. It is especially interesting, says M. Antoniadi, that the principal spot on Moon No. 3 which he has observed is one that Jovian astronomers, if there were any, could never see, just as we can never see the opposite side of our single moon.

THE VELOCITY OF LIGHT

M. E. J. GHEURY DE BRAY writing in *L'Astronomie*, the official journal of the Astronomical Society of France, ventures the daring speculation that the velocity of light is decreasing at such a rate that each year it darts through space about four kilometers a second slower than it did a twelvemonth earlier. He cites in support of his claim the results of determinations of the velocity of light during a period of over three quarters of a century, of which only one, made in 1855 with apparatus which may have been faulty, is really notably out of step.

The velocity of light is usually stated as 186,000 miles, or 300,000 kilometers, per second, which is fast enough to take it seven times around the earth while the clock ticks once. But for exact work in astronomy, physics and other sciences, determinations to fill out the three blank ciphers usually ignored in ordinary statement are desired, and these have been made a number of times. The most recent research was that of Dr. A. A. Michelson, of the University of Chicago, in 1926, which set the figure at 299,796 kilometers a second. This, according to M. de Bray, is the lowest velocity ever observed, but the new determination, on which Dr. Michelson is working now, should turn out even lower.

The series of determinations, in order to their dates, are given by M. de Bray as follows, the figures indicating velocity in kilometers per second

1849	313,300
1855	298,000
1855	305,650
1871	300,400
1885	299,940
1902	299,895
1906	299,880
1924	299,802
1926	299,796

The differences between these determinations are insignificant from the practical point of view, but if the present claims receive support from subsequent determinations, the accepted ideas in theoretical physics, especially those on which relativity is based, are in for a revolutionary upsetting.

A COLOR TEST FOR TOXINS

A COLOR test for diphtheria and tetanus toxins has been discovered by Drs. Lucy Mishulow and Charles Krumwiede, of the New York City Health Department.

NEW SCIENTIFIC BOOKS

William Wood & Company, New York

THE NATURE OF MATTER, GRAVITATION AND LIGHT. Albert P. Mathews. 218 pp. $3.50.

The effort of the author in this work is toward the correlation of the various aspects under which the universe appears to us, that is, a formal or geometrical aspect; a kinetic or mechanical aspect; an electrical; a magnetic; and a psychical aspect.

The Oxford University Press, American branch, New York

MODERN ECLIPSE PROBLEMS. F. J. M. Stratton. 34 pp. $0.85.

This is the Halley lecture delivered by Dr. Stratton on May 20, 1927, with notes for the observation of the eclipse of June 29, 1927. It should prove of interest to any one engaged in the study of astronomy.

Ginn & Company, Boston

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Up to the present time the standardization of toxins, which play such an important part in modern therapeutics, has been based on a system by which the strength of a batch of toxin could only be determined by trying it out on laboratory animals. This procedure involves inoculation of many guinea pigs, endless calculations and observations and the keeping of innumerable records. Animal tests give satisfactory results but chemical tests, when possible, are much more rapid and exact.

In the process of trying out different reagents to detoxify diphtheria toxin Drs. Mishulow and Krumwiede found that the chemical compound gold chloride gave an interesting color reaction when mixed with the toxin. The investigators then proceeded to determine if a quantitative relationship existed between the strength of the toxin and the color produced. Their results indicate that such is the case. By means of the color tests they have been able to estimate the strength of the toxins and have found that this estimation checks approximately with the toxin value obtained by animal tests. If subsequent research bears out these results another great discovery will have been added to the credit of modern medicine.

TEMPERATURE IN RELATION TO TOXIC SHOCK

THAT the varying resistance put up by men and animals to toxic shock by bacterial poisons and other foreign substances introduced into the blood may be due to the temperature of their surroundings is indicated by the studies of Professor E. Friedberger, director of the Research Institute for Hygiene and Immunity in Berlin.

Dr. Friedberger made parallel tests of the toxic effect known to scientists as protein anaphylaxis, using in one series animals kept in unheated cages at from 38 to 42 degrees Fahrenheit, while in a second series the temperatures were those of an ordinarily comfortable living room. He found that the animals kept in the cold held out against doses of the poison 150 times as great as the quantity needed to kill their companions that had lived in the warmth.

No difference of any importance was observable in the body temperatures of the two sets of animals, but the outdoors set of course had to keep themselves warm by more rapid internal oxidation processes; and this may have made for more rapid elimination of the poison.

Professor Friedberger calls attention to the practice followed by some physicians, of keeping patients afflicted with infectious diseases, as well as soldiers with dangerous wounds, in unheated booths or stalls exposed to the outer air, rather than in well-warmed hospital wards. This practice has been wholly empirical, but these experiments may be the foundation of a rationale for such a procedure.

ARTIFICIALLY RIPENED FRUIT

THE food value of the tomato, ripened by the application of ethylene gas rather than through natural agencies, is under question by the American Medical Association.

During the last three or four years the use of ethylene gas to ripen fruits and vegetables after they have been picked has increased by leaps and bounds. A single dose of ethylene, according to one investigator, consisting of about two or three cubic feet at a cost of 40 cents to the carload of fruit, is sufficient to produce a remarkable change in the time necessary to ripen bananas and to change their color, flavor and texture. It has become the custom to bring green lemons and oranges to a ripe tint by exposure to ethylene. The ethylene treatment of celery is reported to have increased the sugar content from 20 to 30 per cent., while tomatoes subjected to this method are said to have a fine flavor and color.

The chemistry of this reaction is not at the present time well understood. It has been suggested that the presence of the ethylene acts as a catalyst in the conversion of starch to sugar, but this contention has been disputed by some investigators. The American Medical Association points out that while this development is of vast importance commercially, the health phases of the subject have as yet received little attention.

Certain fruits and vegetables are recommended by physicians largely because of their vitamin content; whether or not this is altered by ethylene has not been determined. Possibly, also, the fruits and vegetables may be picked earlier than has been the practice, thus shortening the period of irradiation by the sun. Physicians may well watch the development of this form of food enterprise; perhaps the time may come when certain every-day foodstuffs will be purchased on the basis of vitamin units. In the meanwhile, the use of vitamin-containing products in as near a "naturally ripened" condition as possible should be encouraged when used for prophylaxis against vitamin deficiency.

THE FERTILIZATION OF WHEAT

FORCIBLE feeding methods applied to plants promise to improve the quality of wheat, and incidentally to improve the price the farmer gets from the miller.

An exhibit of the results of applying nitrate fertilizer to wheat fields, not at the conventional time just before sowing but much later in the season when the grains are well into their formative period, were shown at the Chemical Exposition in New York.

The method was worked out by Dr. Jehiel Davidson, of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture. He applied 100 pounds of sodium nitrate per acre to wheat land when the crop was in the early stages of ripening. When the grain was harvested it was found that the protein content had been increased by 27 per cent. or more over that in grain from similar but untreated fields.

Since a large proportion of this protein increase is in the form of gluten, the stuff that makes flour sticky and suitable for bread-making, millers are often willing to pay a premium amounting to about 30 cents on the bushel for this grade of wheat. At twenty bushels to the acre, this premium amounts to $6 per acre. The cost of the fertilizer averages $3 per acre, and the net profit to the farmer for adopting this new system of later fertilizer application therefore amounts to about $3 per acre.

Ordinary wheat naturally high in protein is generally

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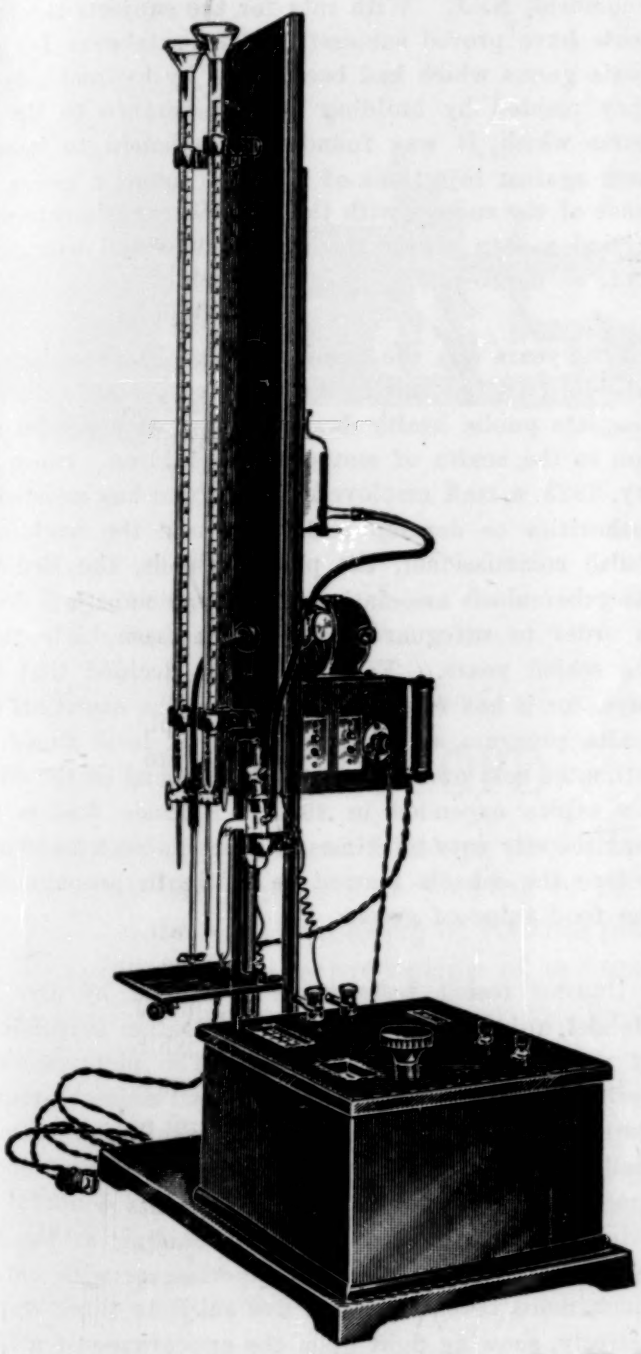

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shrunken, which detracts from its value, while the wheat obtained by the method described above is just as plump as normal wheat. Baking tests carried out by Dr. Davidson together with J. H. Shollenberger, of the Bureau of Agricultural Economics, have shown that the high protein wheat obtained in the new way yields bread of superior qualities. It is thought not unlikely that the housewife may be willing to pay a premium on flour yielding a better bread.

THE ORNITHOLOGICAL STATION IN HELIGOLAND

Concentration of bird airways during the spring and fall migration season has turned the island of Heligoland, before the war Germany's strongest fortification, into an important ornithological station.

On the higher part of the island is located a bird house and a small fenced-in area which is planted with bushes, trees and undergrowth. As this spot has practically the only verdure found on the rocky island, the migrating birds are attracted to it and caught by means of two large weirs which are located here and effectually hidden by the undergrowth. Food and decoy birds help attract the migrants. Some of the rarer species are kept in the bird house for the purpose of observation or exhibition.

From time to time during migration an airplane has been used to observe the flights, and, in order to facilitate the recovery of small banded birds, the station has for some time followed the practice of coloring the feathers of these captives with a green, red or blue preparation. This experiment has been successful as many such colored individuals have been recaptured.

The majority of migrating birds pass over the island at night, and as many as twenty or thirty kinds have been frequently noted. On one occasion the director noted fifty kinds in one night. These birds concentrate on the lighthouse on dark nights. Attracted by the brilliant light, they circle around it and settle upon the ground to rest, when they can be captured.

In order to prevent birds from being stunned or killed by dashing against the light a system of external reflectors has been placed on the lighthouse tower, so that most of the birds detect it in time and avoid the danger.

Since May 30, 1909, the bird protection law of the Reich has been in force on the island; by it a number of specified birds were protected, but only during specified months. Since April, 1926, the provisions of the Prussian bird protection law have been made applicable to Heligoland. A number of birds are protected all the year round and many more during the breeding season.

ITEMS

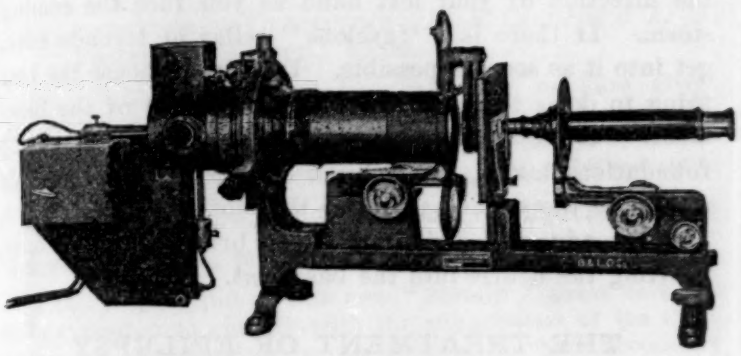
THE inauguration of autumn was an early evening event this year, according to the U. S. Naval Observatory, which determines and broadcasts the nation's official time. The exact moment at which the sun crossed the equator has been determined at 8:17 P. M., Eastern Standard Time, on Friday, September 23. At this time, day and night were of equal length all over the world; thereafter and until the winter solstice, when the sun reaches its farthest south and starts northward again, the daylight hours in the northern hemisphere become progressively shorter, while in the southern hemisphere they become correspondingly longer.

EXPERIMENTS in immunization against pneumonia by the feeding of acid-killed pneumonia germs are being watched with interest by the New York City Department of Health, according to Dr. William H. Park, director of the Bureau of Laboratories. Although the health department is taking no part in the experiments it is following carefully the work being done by Dr. Victor Ross, of Bloomfield, N. J. With rats for the subjects the experiments have proved successful. The rats were fed pneumonia germs which had been killed by hydrochloric acid. They reacted by building up a resistance to the dead germs which, it was found, was sufficient to immunize them against injections of living pneumonia germs. Because of the success with the rats the experiments will be carried a step nearer the human race and will next be made on monkeys.

FIVE years ago the Commonwealth Fund undertook to subsidize, in the small city of Fargo, North Dakota, a complete public health demonstration with special attention to the health of mothers and children. Since January, 1923, a staff employed by the fund has assisted local authorities to develop and coordinate the work of the health commissioner, the public schools, the Red Cross, the tuberculosis association, local physicians and dentists, in order to safeguard child health from birth through the school years. Fargo has now decided that health pays, for it has voted to carry on all the essentials of the health program and finance it out of local funds at an estimated cost of $1.40 per capita instead of the 88 cents per capita expended in 1922. Produce dealers report that the city eats ten times as much spinach as it used to before the schools started to instigate propaganda for the food value of greens.

DURING recent tests made in Berlin by Dr. Victor Mendel, animals and birds showed a rather surprising lack of response to moving pictures. The pictures were especially selected for each animal and animal group, and the experiments were made in an exhibition room especially adapted to the purpose. The response of dogs was practically nil. Only a little mongrel of doubtful origin evinced a momentary interest by sniffing at the human figures on the screen. The experiments with cats were much more favorable. Of five subjects three responded actively, showing fight upon the appearance of a big dog on the screen. Experiments with birds were rather negative. Geese and ducks, chickens and pigeons paid some attention, while owls showed great interest. Small birds and barnyard fowl showed anxiety when a hawk appeared in their line of vision. A squirrel displayed interest when a weasel made its appearance on the screen, but reptiles and fish were, as might have been expected, quite indifferent.

MICRO PROJECTION



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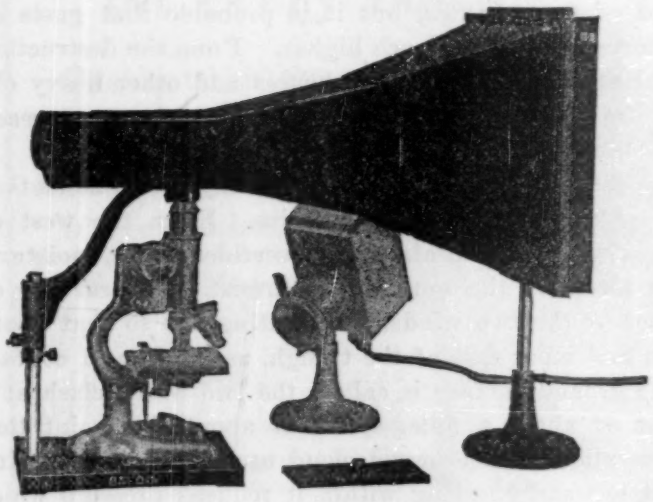

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SCIENCE NEWS

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THE ST. LOUIS TORNADO

THE tornado that devastated parts of St. Louis on September 29 was not an unusual storm from the standpoint of the meteorologist except for the fact that it unfortunately occurred in a densely populated area.

Like most of the tornado disturbances for which the Mississippi region is noted, the recent storm left in its wake at least four affected localities, according to unofficial reports reaching the main office of the U. S. Weather Bureau. Tornadoes were reported at Muskogee, Okla., in northwestern Arkansas, St. Louis and near Danville, Ill. A line running northeast can be drawn through these places indicating that the general storm giving rise to the local tornadoes moved in this direction. This is another confirmation of the meteorological belief that the tornado storm travels from the southwest to the northeast.

The spinning whirls of destructive winds are not themselves in the center of the general storm giving rise to them. In the recent disturbance the "low" area where the barometer registered the least atmospheric pressure was somewhat to the northwest of the point of destruction. On the morning of the St. Louis tornado the "low" was in western Nebraska, in the evening twelve hours later it had moved to southeastern Minnesota and the next morning it was northeast of Lake Superior.

The most vicious storm on earth, exceeding in violence the tropical hurricane, the tornado is fortunately of short duration and covers only a small area of the earth's surface. At any one place the storm does not last more than a few minutes.

At St. Louis a wind velocity of 72 miles an hour was officially measured by the Weather Bureau station over a period of five minutes, but it is probable that gusts at the storm center were much higher. From the destruction caused and the way bridges, houses and other heavy objects are handled by the wind, the velocities must reach 400 to 500 miles an hour in some tornadoes.

The cause of the tornado is essentially the same as that of a severe hail or thunder storm. From the west or northwest comes cold air which overrides warm, moisture-laden air from the south or southwest. The surface of contact of the two winds is a slanting one so that about a hundred miles east of the trough, as the line of contact at the ground surface is called, the two winds clash at a height of about a mile. It is at about this point that the so-called funnel-shaped cloud usually forms, whirling like a top and carrying within it reduced pressure which causes houses in its path to literally blow up because of the released pressure within them. The warm air beneath, charged with moisture and immense energy, sets up a most violent convection and vertical overturning of the atmosphere which results in the typical tornado vortex, an immense eddy in the ocean of air.

Due to the limited area affected by the tornado and the impossibility of predicting just where it will occur, the Weather Bureau does not attempt to issue forecasts of these storms other than to warn of "severe local storms." If tornadoes were definitely predicted hundreds of thousands of people might be unnecessarily worried and the loss due to this condition might greatly exceed the damage that might be prevented.

About a hundred tornadoes occur each year in the United States and they take a toll of about 300 lives yearly on the average. The tornado season for most of the country is from March to October. Little can be done to protect against the tornado, but meteorologists give this advice: If you see the tornado cloud advancing toward you, run northward or toward the northwest, in the direction of your left hand as you face the coming storm. If there is a "cyclone" cellar or tornado cave get into it as soon as possible. In a frame house the best thing to do is to go to the southwest corner of the basement. A frame house is likely to be taken off its foundations intact. In a brick or masonry structure, do not go to the cellar as that is the most dangerous place. The tornado will disintegrate the brick house at once, whirling the débris into the basement.

THE TREATMENT OF EPILEPSY

EPILEPSY, the mysterious, incurable "falling sickness" that has afflicted mankind since the beginning of history, is now under medical attack from three separate angles.

Several years ago it was established that starvation brought about certain changes for the better in epileptics so long as they could endure the drastic treatment. Recently a diet that approximates some of the conditions of starvation has been found to give very successful results with epileptic children. Confined to the prescribed diet which calls for much fat but little sugar, afflicted children have shown marked improvement lasting over a period of years.

In addition, careful and understanding psychological handling has proved to be of great value in avoiding much of the mental and emotional strain that leads up to epileptic seizures.

Now a new weapon in the shape of the drug luminol-sodium is announced by Dr. J. Tyler Fox in a report to the medical journal, *Lancet*. Dr. Fox has tried out the drug in carefully regulated doses on members of the epileptic colony in Surrey, of which he is superintendent. Of 167 cases, 50, or around 30 per cent., showed benefit that is likely to be permanent. Fifty-one cases after registering improvement for a period of three months apparently became tolerant to the drug. The remainder either showed only temporary gains or remained unaltered by the treatment. A very few became worse.

The best results are to be expected from young patients. Some patients have continued to receive the treatment for periods as long as four years. The drug should be administered with great caution because in some cases the number of fits have increased after the luminol was stopped. In a few cases where the number of fits de-

NEW SCIENTIFIC BOOKS

The McGraw-Hill Book Company, New York

MUSCULAR MOVEMENT IN MAN. A. V. Hill. 100 pp. $2.50.

The lectures on which this book is based were delivered during the second semester of 1926-27, under the Non-Resident Lectureship in Chemistry at Cornell University, which was endowed by George Fisher Baker.

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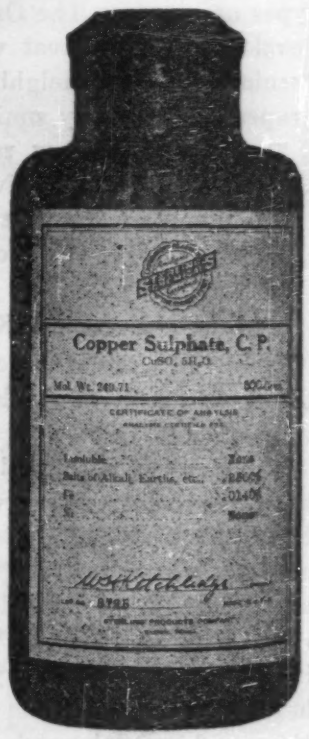

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creased the behavior of the patients became violent and uncontrolled. The treatment appears to be of benefit in certain types of cases, but should not be undertaken where careful supervision and accurate records of each seizure can not be maintained for each patient.

OVERPRODUCTION OF GRAPES IN CALIFORNIA

SERIOUS overproduction of grapes in California is in prospect, in spite of an ever-increasing demand by eastern home wine-makers. A newly issued bulletin of the California Agricultural Experiment Station, written by S. W. Shear and H. F. Gould, is devoted to a discussion of the economic status of the grape industry in California.

"The rapid expansion of the grape industry in California as compared with the rest of the United States has been primarily the result of prohibition, which caused a sudden and great reduction in the utilization of wine grapes by California wineries and a gradual but tremendous increase in eastern consumption of fresh wine and raisin grape varieties for juice purposes. Before 1915 practically none of the grapes shipped from the state were designed for wine-making. By 1921, however, almost 20,000 carloads of juice stock were shipped, and in the last two years an average of nearly 50,000 carloads, or approximately 70 per cent. of California's grape shipments, have been juice stock."

The many varieties of grapes grown in California can be divided into three main classes: wine, raisin and table grapes, according to the uses for which they were bred. However, the authors state, a considerable proportion of the raisin and table varieties are now diverted to wine-making, in addition to the entire wine grape crop.

The great demand by the eastern market for grapes has led, as might have been expected, to a large increase in vineyard acreage, both in California and in other states adapted to vine culture. The Great Lakes states, particularly New York, furnish heavy competition in certain types of grapes. The Ozark region in Arkansas has also developed into a great vineyard country. Finally, California's next-door neighbor, Arizona, has taken to raising grapes of types very similar to California's own.

The two economists recommend a curtailment in new acreage, and better cultivation practices to cut production costs, as means for keeping prices at a level that will show a profit for the grower.

STONE AGE SKULLS FROM AFRICA

WHAT was the strange race of men that lived in equatorial Africa in the twilight time between the Old Stone Age and the New?

An English anthropologist, L. S. B. Leaky, who has been conducting extensive excavations in Kenya Colony, brings back with him a budget of extremely puzzling skeletal remains but refrains for the present from offering any answer to his own riddles.

Most of the bones he found at his two principal working locations, Mr. Leaky states, were badly broken, but he did find at least one skeleton in nearly perfect condition, and several good skulls. The skulls are most extraordinary. They do not resemble the skulls of the Negroes now inhabiting the locality at all, and they are very little like any Negro skulls, except that they are very narrow for their length.

Their faces, however, are high and narrow instead of being short as typical Negro faces are.

One of the most notable characteristics that marks these skulls as non-negroid in aspect is the very narrow nose-opening. The average Negro, of course, has always been noteworthy for his wide nose. One of the skulls also exhibits a most extraordinarily high palatal arch. The top of the palate is 29 millimeters, or over one and one eighth inches, above the grinding surface of the teeth. This is seven millimeters higher than the corresponding measurement in the average European mouth, and 13 millimeters higher than that in a number of Negro skulls measured locally.

Associated with the human remains were many stone arrow and spear points and bits of pottery. The workmanship corresponds in a general way with that of similar finds in Europe belonging to the transition period between the Old Stone Age, when men used chipped stone implements, and the New Stone Age, when the art of a finer polished finish was discovered.

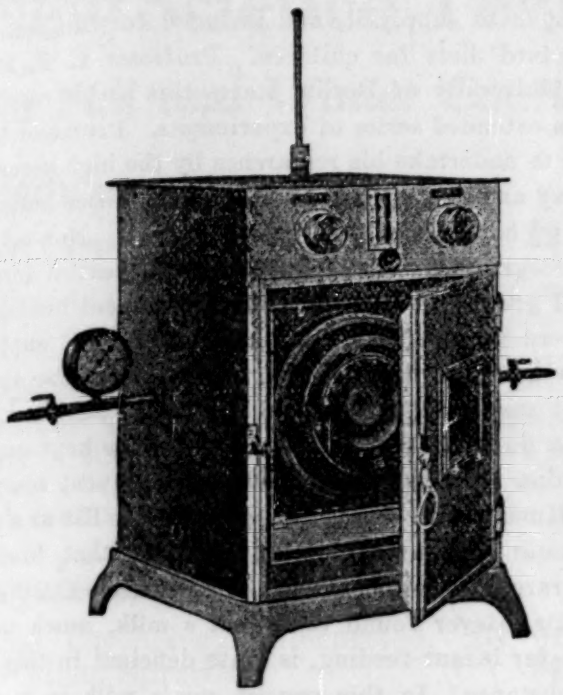
THE QUADRUPED METHOD OF LOCOMOTION

IF a baby is learning to creep on all fours like a bear —and he probably is not, for such cases are very rare— he is showing atavistic traits. Dr. Aleš Hrdlička, of the Smithsonian Institution, describes in a forthcoming issue of *The Journal of Physical Anthropology* five such cases of babies that prefer the quadruped method of locomotion before they learn to walk. Most of them are between one and two years old and actually travel on all fours like little animals, not putting their knees on the ground at all as babies normally do in creeping. The babies came from the widely different races, white, American Indian, Negro and Australian, and are all healthy, physically normal infants.

They run on all fours easily and by choice, not by accident, through imitation or by being so taught. They all show the same type of posture and progression, with nothing strained or cumbrous in either posture or movements.

The immediate cause of running on all fours can only be explained at the present time, Dr. Hrdlička believes, on the simple grounds that these children find it the easiest and most efficient mode of locomotion at this particular stage of their development. If this were the only reason, however, creeping as a bear walks would be the exception rather than a rule; so it appears that there must be some additional factor connected with the nervous system.

"In general," Dr. Hrdlička explains, "in the human child of to-day, this factor is evidently dormant, and so, though the little body would lend itself, there is no incentive to running on all fours. Such a dormant impulse may perhaps be aroused accidentally by some chance trial but it is more likely that in instances this impulse is



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stronger than in the general run of infants, resulting in the quadruped progression. Such a mental impulse in an otherwise normal and healthy child could hardly be ascribed, it would seem, to anything else than something of an atavistic nature.'' One observer, he adds, has reported that walking on the hands and feet, exactly like young apes, is common among babies of tribes of West Africa.

THE PSYCHO-GALVANIC REFLEX

As the result of the researches of Dr. David Wechsler, of New York City, the skin has been found to be a delicate emotional barometer, greatly increasing its resistance to the passage of electricity when one is quiescent, but permitting the current to go through much more readily when the feelings are even moderately aroused.

Of all the tissues of the body, the skin is one of the best insulators. The flesh and blood within conduct electric currents very easily, but the skin serves as a protection against these as against many other external vicissitudes. But like all non-conductors, it offers much less resistance when it is moist.

It is of this latter fact that Dr. Wechsler has taken advantage. It is common knowledge that we perspire, sometimes very heavily, under severe emotional stress. The cold sweat of fear, the flushed, damp face of anger, are familiar examples. But even less extreme emotions, it has been found, cause a less perceptible but stilll unmistakable moistening of the skin.

Dr. Wechsler's procedure is simple. He includes a part of his subject's skin in an electric circuit by having him dip his hands, or even merely two fingers, in salt solutions in which two wires end. In the same circuit he includes a sensitive instrument to detect and record changes of the current.

So long as the subject is sitting still and thinking of nothing in particular, the indicator hangs motionless. But if a sentence is spoken, or an object or picture shown, which arouses his interest, anger or fear, the indicator instantly jumps upward, indicating an increase in the amount of current which has passed, corresponding to a decrease in the resistance of the skin.

One of the first suggestions made for the use of this method was of its possible value in criminology. Naturally a criminal would have a rather marked emotional reaction if some one suddenly snatched away a curtain, revealing the corpse of his victim. But Dr. Wechsler emphasizes the statement that this will not be its principal use by any manner of means. The apparatus can measure reactions much more delicate than that, it is stated.

In one experiment a mathematical problem was set before a mathematician and his conductivity curve rose to a peak, where that of an ordinary person would not have come out of its regular straight line.

In another test, a number of machine operatives were examined together, and their sensitivity as measured by the apparatus was found to run closely parallel to their known records of comparative skill. The principal use of the electrical emotional tests therefore is expected to be found in the field of vocational guidance.

ITEMS

VITAMIN C, the substance that wards off scurvy, is present in milk as well as in the fresh vegetables usually relied upon to supply it, and included for this reason in all standard diets for children. Professor L. F. Meyer, of the University of Berlin, states this as his conclusion after an extended series of experiments. Professor Meyer was led to undertake his researches by the high occurrence of scurvy among the children in German cities during the period of hard times just after the war. Not only the fully recognizable disease but also such partial forms as arrested growth and sub-normal development among children were distressingly manifest. While the supply of fresh vegetables was not up to standard, the German scientist suspected that the milk shortage also had something to do with it. Tests on guinea pigs kept on a deficient diet have shown that milk can prevent scurvy, he says. Human milk stands at the top of the list as a source of vitamin C, thus explaining the fact that breast-fed babies rarely or never contract this disease. On the other hand, Dr. Meyer found that goat's milk, much used in Europe for infant feeding, is quite deficient in this necessary substance. In this respect cow's milk is much superior to that of goats.

GAMBUSIA, the little fish that befriends man by devouring mosquito ''wigglers,'' is finding things even more to his liking in the ponds and ditches of Italy than in his native American home, according to reports received from Rome. Carried first to Spain and thence to Italy to combat the malarial mosquitoes, this hungry little minnow has multiplied enormously throughout the region around the mouth of the Tiber, where it was first introduced, and has also been transplanted into shallow waters throughout the peninsula and along the Dalmatian coast. More favorable food and other environmental conditions, and probably the absence of natural enemies that take toll of its numbers in America, are credited with the gratifyingly abnormal rate of increase.

How the British hold the cholera situation in hand when ten million Hindus set out on a pilgrimage is one of the dramatic episodes revealed in a report just issued of the tenth extraordinary session of the health committee of the League of Nations. Approaches by rail and by road to the districts of Hardwar and Muttra where pilgrims by the million concentrate on the occasion of the Hardwar Fair were protected by inspection posts and first aid stations. Barbed wire entanglements barricaded ponds of stagnant water from the onslaughts of thirsty travelers. Safe supplies of drinking water were stationed along the route, while the river water at Bhimgoda temple where the pilgrims bathed was purified by chloride of lime. Cholera inoculation free of charge was provided for at hospitals along the way. The project of compulsory inoculation of all pilgrims for Asiatic cholera had to be abandoned as impractical on account of the vast numbers of individuals involved. As a result of these precautions only 38 cases were notified after the fair, according to the report. Of these 36 were imported from other provinces; some as far away as Bengal and Assam.

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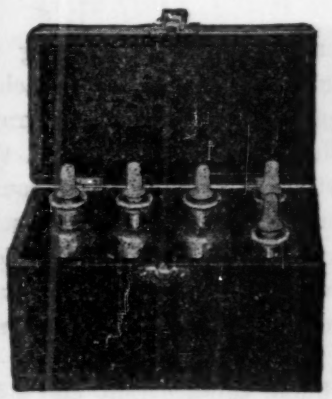

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SCIENCE NEWS

Science Service, Washington, D. C.

ELECTRIC WELDING

ELECTRIC welding and the flame cutting of metals are revolutionizing the building of large machines and replacing the making of large expensive castings. How this development is saving industry and the public many thousands of dollars annually is told in a report of the Engineering Foundation just issued.

Although for many purposes castings have advantages all their own, the report explains, many delays and losses are caused by the difficulties in the making of large castings for specially designed machines.

Suppose a large electrical generator is being built. Huge castings, specially designed, are necessary for the base. As the designer bends over his drawing-table the parts take shape in his trained imagination. Constantly questions run through his mind: Can the pattern-maker build this? How must he divide it so that the pattern can be obtained from the sand mold? Will the molten metal flow into this part readily? Will the flowing metal "cut" or "wash" the mold here, injuring the casting in more ways than one? Can that pocket be vented of the gases liberated from the molten metal? Will this part crack away as the metal cools and shrinks? Will that very thick part be spongy?

Under the guidance of experienced engineers and metallurgists, the designers, pattern-makers and foundrymen provide for one difficulty after another. Finally, after months of preparation, the hour for the great adventure arrives and the metal is poured. More days go by as the casting is slowly cooled, stripped and cleaned. Tons of "gates" and "risers" are cut away. A rigid inspection is made, possibly with the aid of X-rays in search of hidden flaws. Then the casting is shipped to the machine-shop.

One after another certain parts of the casting are machined on boring-mills, planers or other large machine tools. The last face is being machined; the tool gradually uncovers a narrow crevice. Probing reveals a thin cavity extending into the casting at a place where soundness and strength should be unquestionable. The casting must be rejected! Months of time are irrecoverably lost, together with great expense incurred in foundry and machine-shop and for transportation. And the same risk must be taken again!

Now, through the use of flame torches that cut metal easily and welding devices that join together metals so effectively that they seem to have always been one, standard steel slabs, plates, bars and other structural shapes easily obtainable in the open market are built up into structures superior to the castings formerly required. The steel surfaces, unmachined, are good enough for many purposes. Dimensions are very close to standards without further work. Wastage of metal and weight are much reduced.

The designer enters a new field of wider freedom wherein materials and technique more closely satisfy the principles underlying his work. He no longer has to use metal an inch thick and liable to breakage where a tough ⅛-inch plate is much better. Construction may begin as soon as designs are developed. There is no waiting for castings. Designers no longer are hampered by economic necessity to reutilize old patterns. Storage for patterns and their loss by fire disappear. Some machines can be completely fabricated in less time than formerly was consumed in making patterns. Predictions of cost and delivery can be made with less uncertainty.

In the new technique, steel up to 8 inches thick is flame-cut within 1/32-inch of desired dimensions, with surfaces smooth enough to be painted or requiring but light cuts if they are to be machined. Flame-cut parts match satisfactorily for welding. Half-inch plates are cut at a rate of 15 inches a minute, and 2-inch plates at 7½ inches. Welding is done by electric arcs on machines which make most of the operations automatic and more rapid than hand work.

GAS AS FURNACE FUEL

GAS made from bituminous coal was declared the ideal household fuel of the future in a report by Professor S. W. Parr, of the University of Illinois, to the first national fuels meeting held in St. Louis under the auspices of the American Society of Mechanical Engineers.

Charging that the average home and apartment heating plant is guilty of producing most of the smoke nuisance of cities, Professor Parr predicted that raw coal would eventually become obsolete as a fuel and that instead the soft coal would be processed to produce a solid smokeless fuel more desirable than anthracite, gas of high quality and tar from which drugs, dyes and many other chemicals can be obtained. Smokeless combustion, high efficiency, cleanliness and convenience give gas a status unapproached by any other fuel.

Why smoke practically always results from the burning of bituminous coal in ordinary furnaces was explained. When coal is heated it gives off gases, among them marsh gas and ethylene. Before marsh gas will burn it must be heated to a bright cherry red heat, about 1,200 to 1,300 degrees Fahrenheit, and ethylene requires a temperature half as great. If such gaseous products of coal strike a cool surface that lowers their temperature below their ignition points, or if there is not enough oxygen to allow them to completely combust, they become smoke producers instead of giving off heat.

In the large steam-generating plant the production of great volumes of smoke is an unnecessary extravagance, inefficient, wasteful, unsanitary and avoidable. Proper combustion can be controlled in a very effective manner by such devices as slow and evenly distributed additions of coal or by special setting of the boiler, hence the modern mechanical stoker and the elevated or elongated boiler settings to provide both space and time for the combustion of gases before cold surfaces are encountered.

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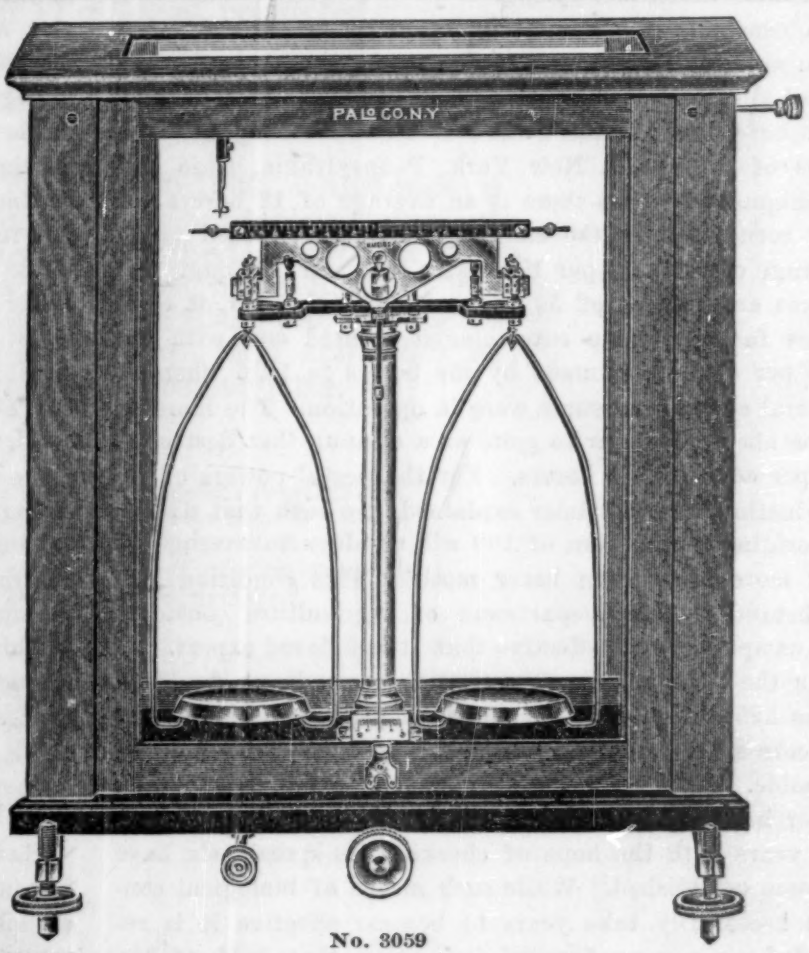

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The case, however, with the average household or apartment heating unit is entirely different. Here the high heats do not prevail. The mechanical stokers as well as the spacious combustion spaces are absent. Moreover, the man of the house or the janitor has other duties to perform, whereupon he fills the combustion chamber to the limit and sets the dampers for a prolonged period of automatic control, during the major part of which period the so-called heater is simply a device for stewing off tars and vapors of inconceivable variety as to composition, odor and filth for the effective work of polluting the atmosphere. In the very nature of the case, such conditions must exist and continue to prevail in any household appliance where raw coal is fed into the furnace. No matter by what name the furnace or the coal is known, by any other name they would smoke just the same, and the worst part of the picture is not fully presented until mention is made of the fact that as a result of exhaustive studies made in many congested centers, it is demonstrated that the major part of the smoke nuisance has its origin in the domestic chimney and in the larger units of flat and apartment buildings where combustion conditions in the furnace are substantially as described above.

THE CORN BORER CAMPAIGN

"THE corn borer campaign has been successful and has accomplished as far as is humanly possible the object set out to accomplish." This is the verdict given out by the executive committee of the international corn borer organization on the ten-million dollar war on the corn pest undertaken last spring.

A census of the borer population by actual count has been made in approximately 750 townships in the heavily infested states, declares Dr. W. H. Larrimer in charge of corn borer work at the U. S. Bureau of Entomology. Results of surveys in New York, Pennsylvania, Ohio and Michigan show that there is an average of 13 borers per 100 corn-stalks in the campaign area as opposed to an average of 8 borers per 100 stalks last year. Though this means an increase of 50 per cent. for this year, it compares favorably, the entomologist pointed out, with the 300 per cent. gain made by the borers in 1926 when no general control measures were in operation. The increase came about this year in spite of a cleanup that destroyed 95 per cent. of the borers. For the pests' powers of reproduction, Dr. Larrimer explained, are such that five of an original population of 100 will produce an average of 150 more adult corn borer moths. This condition notwithstanding, the Department of Agriculture considers the campaign more effective than it had dared expect.

In the light of the fact that the corn borer feeds on some 225 plants with an expressed preference for a diet of corn-stalks, eradication of the pest is considered impossible. Of twelve natural insect enemies of the corn borer imported into this country from Europe in the last six years with the hope of checking its spread, six have become established. While such means of biological control necessarily take years to become effective it is regarded as a very hopeful indication that half of the species of corn borer enemies introduced have beco permanent residents.

Of the ten million dollars appropriated last spring fight this foe of America's corn crop, no money has be used for quarantine or research purposes. The bulk the appropriation has been spent on compensation farmers for extra work, special machinery, field equi ment and supplies and a far-reaching educatio program.

Special commendation is ceded to the farmers that c operated in the war on the pest by the entomologist agronomists and agricultural engineers at work on t problem, Dr. Larrimer declared.

SUBSTITUTE FOR BUTTER

A BUTTER substitute that will contain as many calori and more vitamins than the old-fashioned product of th cow can be made available at a low price, scientists i London declare.

In view of the general shortage of dairy products, chie source of the vitamins necessary for health and growth Drs. O. Rosenheim and T. A. Webster, of the National Institute for Medical Research, have suggested to the scientific journal, *Nature,* a cheap and effective butter substitute. Fats from the livers of such readily available animals as sheep, calves and oxen, they report, contain ten times the amount of vitamin A as exists in cod-liver oil.

"The well-known skill of the margarine manufacturer," Dr. Rosenheim explains, "should enable him so to incorporate the liver fats with his product as to convert a dietary article, already identical with butter in calorific value, into a cheap and palatable product of equal biological efficiency, so far as vitamin A is concerned."

The no less important rickets-preventing vitamin D, another variable constituent of butter, can be supplied by mixing in small quantities of irradiated ergosterol. This is a recently discovered product of great potency, believed to be the parent substance of the anti-rachitic vitamin. After exposure for regulated periods of time to ultra-violet light, it is capable of curing human rickets in as small doses as from two to four milligrams daily.

"The margarine manufacturers," continues Dr. Rosenheim, "have therefore at their disposal, if they care to make use of them, means which should make a perfect biological substitute for butter accessible, without unduly raising the price of margarine. Moreover, by carefully controlled methods of manufacture, it should be possible to supply a product of constant vitamin content, superior in this respect to natural butter, the vitamin content of which depends on too many uncontrollable factors in the food supply of the cow."

EXPEDITION TO NUNIVAK ISLAND

HAVING to get school children to act as interpreters for him was the unusual experience of Henry B. Collins, Jr., ethnologist of the Smithsonian Institution, who has just returned from an expedition to Nunivak Island, in the

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Bering Sea. Mr. Collins and his associate, T. Dale Stuart, are the first scientists to visit this Alaskan island or to study its people.

"No adult on Nunivak speaks English, except for the school teacher and her husband, who are sent there by the U. S. Bureau of Education," said Mr. Collins in describing his expedition. "The children are taught English at school and speak it very well. Since they have heard only these two Americans use the language, the little Eskimos have reproduced some of the tricks of speech of their teachers, even to saying, 'Oh, dear,' which is a frequent expression used by the American woman."

The primary object of the visit to this inaccessible island was to collect skeletons and to measure the people and study their habits.

"The people live in houses made of drift logs," said Mr. Collins. "They excavate to about three feet and build part of the house underground, for greater protection against the cold. Sod is placed over the wooden structure, and in winter when the sod and the foundation soil freeze, they make a kind of thermo-blanket and really keep the house warmer than it is in summer. This is fortunate, for the people have no house fires. Wood is scarce, and every log that drifts in from the sea is urgently needed for kitchen fires and for building purposes. Snow houses are unknown among these Eskimos, and indeed no Alaskan Eskimos live in the round snow huts supposed to be typical of the far north.

"When the teachers came there four years ago, they found the natives of one village living in four large houses, one for the men and three for the women. The unmarried men lived regularly in the men's council house, and the married men lived there for about five months in the year. This sort of separation of the sexes is found among native tribes, but nowhere have the ceremonies required that the men stay away from their wives for so great a part of the year. The teachers persuaded the natives to build separate houses, better ventilated and with less crowded conditions, so that now they have their own homes."

In their journey through villages along the southwest and west coast of Alaska for about 400 miles the scientists found only about ten white men and women, the teachers of the natives. In these remote villages and on the still more remote island of Nunivak, they measured over 125 full blood Eskimos, the first natives to be studied in this part of Alaska. The expedition also collected about 200 skulls and 50 complete skeletons which have been brought to the Smithsonian Institution for examination and measurement.

Mr. Collins realized why Nunivak Island is avoided by ships when the schooner in which he was returning to the mainland broke a rudder in a storm and was in considerable danger of being sucked into the treacherous sea. The Eskimo crew succeeded in repairing the rudder and landed the scientists and their valuable skeleton collection safely at St. Michael.

ITEMS

ANOTHER brand of streptococci, the round little germs that look like tangled strings of beads under a high-powered microscope, is engaging the attention of [illegible] George F. and Gladys H. Dick, responsible for the [illegible] velopment of scarlet fever antitoxin. At their laborat[illegible] at the John McCormick Institute for Infectious Disea[illegible] they have found that the streptococcus isolated from s[illegible] lesions of erysipelas is capable of causing a sore thr[illegible] without any of the skin manifestations of this mu[illegible] dreaded disease appearing at all. This result is analog[illegible] with that obtained in their scarlet fever work when [illegible] was discovered that the scarlet fever streptococcus m[illegible] cause sore throat and rise in temperature without t[illegible] suspicion-arousing rash being present. As in the form[illegible] experiments, the inoculations were made on healthy adul[illegible] who offered themselves as volunteers, according to t[illegible] report of the research made to the American Medic[illegible] Association.

CONFIRMATION of the modern medical teaching th[illegible] sunlight is the best preventive of rickets, the disfiguri[illegible] and crippling bone disease of childhood, may be foun[illegible] abundantly in China, according to Dr. A. Hartmann, [illegible] German physician, who has had long experience in th[illegible] Far Eastern republic. The Chinese houses, especially o[illegible] the poorer class, rarely have glass in the windows, he re[illegible] ports; and therefore there is nothing to prevent the ultra[illegible] violet rays, which can not penetrate ordinary glass, from[illegible] pouring into the houses. And cases of rickets are ex[illegible] ceedingly rare among the poorer Chinese in spite of the[illegible] malnutrition and lack of sanitation all too prevalent[illegible] among them.

FROM Halemaumau, the great pit of the Kilauea volcano, great avalanches of loose material have been precipitated into the depths and although there have been no lava outpourings such as appeared in July the slides are taken as indicating continued unrest of this volcano. Many tons of débris have fallen into the pit and partly buried one of the cones, according to a report of the Hawaiian Volcano Observatory. Portions of the wall usually quiet are scarred by slides. Vulcanologists expect that the inner crater of Kilauea will over a period of years gradually fill with lava. The present activity is just an early stage of this portion of the volcanic cycle.

WORKING for the Food Investigation Board, Dr. D. Haynes and Miss H. K. Archbold have found that the keeping quality of apples varies with the chemical composition. If the apples contain a good deal of nitrogen, protein that is, and not much sugar, they will only keep for a short time. If they do not contain much protein and plenty of sugar, they will show excellent keeping qualities. Further evidence that this is the true explanation has been obtained by Dr. Franklin Kidd and Dr. Cyril West, working at Low Temperature Station, Cambridge. They have studied the respiration of apples as a measure of their vital activity. During the "breathing" process the apple oxidizes its store of sugar, and when the store is exhausted death soon follows. Dr. Kidd and Dr. West found that the apples that keep well, those with low protein and high sugar content, respire more slowly than those with poor keeping qualities.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE URBANA MEETING OF THE NATIONAL ACADEMY OF SCIENCES

LEAVES are by no means 100 per cent. efficient in their work of making food with the aid of captured sunlight. In addition to giving off as lost heat a part of the energy they absorb, they also fail to absorb part of the light that falls on them, simply throwing it back by reflection. Researches on this reflection loss by leaves were reported to the meeting of the National Academy of Sciences by Professor Charles A. Shull, of the University of Chicago. Different leaves reflected different proportions of the light that fell upon them and the same leaf reflected light of different colors in different percentages. Thus, the upper surface of a silver poplar leaf reflected 7.5 per cent. of one of the violet hues, and 20 per cent., or nearly three times as much, in the yellow-green part of the spectrum. The upper and lower surfaces of the same leaf have very different reflecting powers. The same silver poplar leaf, which is dark green above but shining white beneath, reflected 8.5 per cent. of the deepest red rays from its upper surface and 50 per cent. of the same rays from its under side. Autumn coloring had a great influence on the reflecting power. The red leaves of the woodbine reflected nearly twice as much red light as they did of violet; but their total reflection was far less than that of the bright yellow birch leaves, which reflected over 40 per cent. of the incident light, as against only about 13 per cent. for the woodbine leaves.

WHAT is the destiny of prairies? What would have become of the great stretches of rolling grassland that began in mid-Illinois and stretched across Iowa and Minnesota and into Nebraska and Kansas if they had not been plowed into corn and wheat fields? These questions, which have been much discussed by botanists and have considerable practical significance in agriculture and forestry, were discussed by Professor H. C. Cowles, head of the department of botany at the University of Chicago. Prairies are of two types. The first, usually found as interruptions in otherwise forested areas, are due to peculiar conditions of soil water, soil chemistry or other soil conditions where they occur, and are known as "edaphic" prairies. The second type are typified by the unbroken stretches of grassland in the West, and their existence is determined by general climatic conditions, regardless of local differences in the soil. The first type of prairie is not a permanent thing. The trees that surround it modify soil conditions along its border until they are able to creep over it and conquer it for the forest. "Tension line" prairies also, that occupy an intermediate position between the first and second prairie types, will in the end become forest if left to themselves. Only the last type, which lies in regions where the rainfall is too scant for permanent forest or where other general climatic conditions are unfavorable for tree growth, will remain permanently prairie.

EVOLUTION under actual field conditions, producing distinctly recognizable animal varieties in less than a man's lifetime, was described by Dr. Frank C. Baker, curator of the museum of natural history of the University of Illinois. The changes described by Dr. Baker took place in an artificial lake created by a dam in Wisconsin. Previous to its construction, the area had been occupied by a number of creeks and small rivers, in which lived several species of molluscs or shell-fish. These were of species very definitely characteristic of a running-water habitat. As their condition of life changed from river to lake, part of them became extinct, part of them betook themselves higher up the watercourses, and part stuck it out where they were. The ones that migrated upstream remained in much the same kind of environment as they had always been used to and their descendants are exactly like the ancestors of sixty years ago. The ones that held on in the old home, while it changed from river to lake, have themselves changed most markedly. In general, their outline has become relatively shorter and thicker and the shells of the snails have developed wider and looser coils. Dr. Baker points out the case as a clear-cut illustration of animals changing into new varieties under the influence of new environmental conditions.

THE time-honored motto, "In union there is strength," is appreciated even by animals so low in the evolutionary scale as worms and star-fish, according to Dr. W. C. Allee, of the University of Chicago, who spoke before the academy. Dr. Allee cited results of his own experiments, as well as the researches of other biologists, which show that aquatic animals aggregated together in clumps or masses stand a better chance against unfavorable conditions than the same animals would stand if exposed to the same conditions separately and alone. For example, one species of marine worm normally dies when it is transferred from its salty environment to ordinary tap-water. But if a large number of them, all tangled in a ball, are put into tap-water, they survive the unfavorable conditions for a considerably longer period. It is believed that the animals secrete some sort of protective material when they are massed into one of these defensive aggregates.

A SERUM partially successful in destroying trypanosomes, organisms of the group that cause the terrible African sleeping sickness, was described by Professor William H. Taliaferro, of the University of Chicago. The organism experimented upon was not the same species that causes the human disease, but is related to it. Injected into a mouse, it will cause the animal's death in five or six days. The same organism does not always kill larger animals, though it makes them sick. If a serum made from the blood of one of these larger animals after its recovery is injected into the sick mouse, the mouse does not die on time. Instead, it apparently recovers, and none of the parasites can be found in samples

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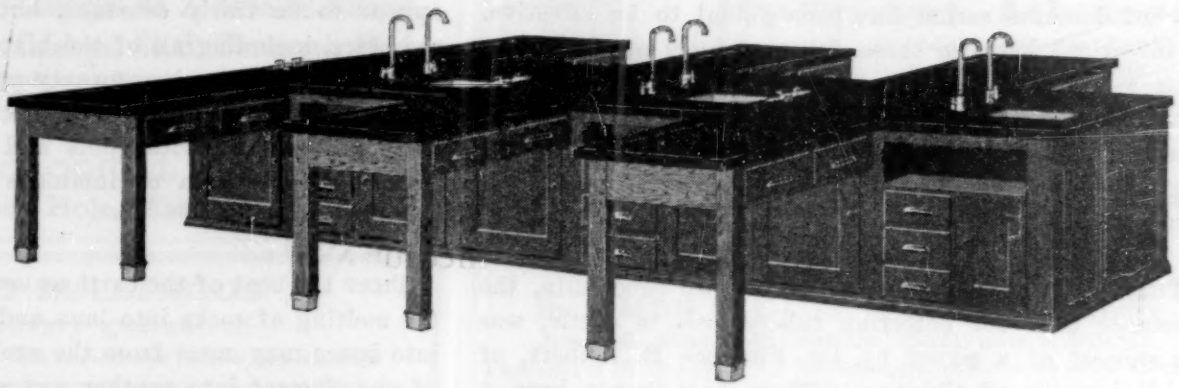

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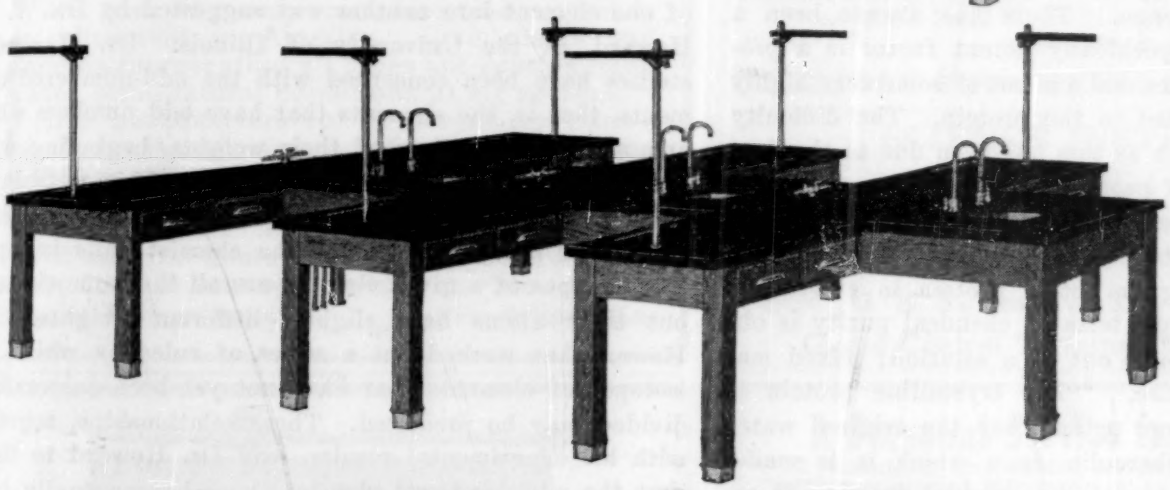

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of its blood. The serum, however, has not yet been developed to a point where it works a permanent cure. After a period of respite, trypanosomes which have survived the attack of the serum begin to multiply again, and this time the mouse dies. Dr. Taliaferro has found that the effectiveness of a given dose of the serum is related to the number of parasites present in the blood. In slight infections, all doses including and above the minimum dose are effective. In severe infections, no dose of immune serum has been found to be effective. In infections between these degrees, doses of the serum greater than the minimum effective dose, instead of always acting to destroy the parasites, show recurrent zones of effectiveness and non-effectiveness. For this phenomenon no wholly satisfactory explanation has yet been offered.

THE riddle of the chemical nature of tuberculin, the substance used for detecting tuberculosis in cattle, was the subject of a paper by Dr. Florence B. Seibert, of the University of Chicago. There has always been a question whether the specifically potent factor is a protein or merely an infinitesimal amount of some very highly active substance attached to the protein. The difficulty in solving problems such as this has been due to the fact that the purification of proteins is one of the most difficult of all tasks in chemistry. In Dr. Seibert's laboratory, however, efforts to obtain a purified product have succeeded in producing an active protein in crystalline form. One of the surest tests of chemical purity is obtained when crystals come out of a solution; mixed materials do not crystallize. "The crystalline protein is purer and therefore more potent than the original water soluble fraction of tuberculin from which it is made. One tenth of a milligram of the original fraction is required to produce a maximum skin reaction in tuberculous guinea pigs, whereas, of the protein obtained from it and recrystallized ten times, as little as four one hundredths of a milligram sufficed to give an equally strong reaction."

THE "quantum," the "atom" of which modern physicists suppose that light and other radiations consist, may be divided. This is indicated by experiments of Dr. A. J. Dempster, of the University of Chicago, reported to the academy. In the experiments he obtained light from a single vibrating atom, instead of many, as in the ordinary light source. But though the light is supposed to consist of single quanta, it behaved just as does ordinary light. When allowed to fall on a lightly silvered mirror, part of the light was reflected and part passed through. When this was recombined the same patterns of light and dark bands were produced as would come from ordinary light.

THE metallic part of stony meteors, which sometimes fall to the earth from the heavens, is very similar to ordinary wrought iron, made artificially, according to a report by Dr. George P. Merrill, of the U. S. National Museum.

RED stars, like Betelgeuse, the northernmost of the familiar group of Orion, which will soon appear in the east as a conspicuous feature of the winter evening skies, are probably spotted like the sun. This is the opinion of Dr. Joel Stebbins, director of the Washburn Observatory of the University of Wisconsin. In collaboration with Dr. C. M. Huffer, Dr. Stebbins has made tests of the light of different classes of stars by studying typical samples of each. The white and yellow stars, he says, appear to be fairly constant, but about a third of the red stars, including all of the biggest ones, vary in light. Some change as much as twenty per cent. in a few weeks. As an explanation of this he thinks it probable that these stars are covered with spots and that as they rotate a greater or less area of luminous surface is exposed to the earth.

THAT the heat of the earth as used in mountain building, the melting of rocks into lava and that which is radiated into space may come from the evolution or transmutation of one element into another was suggested by Dr. W. V. Howard, of the University of Illinois. Dr. Howard's studies have been concerned with the odd-numbered elements, that is, the elements that have odd numbers when arranged in the orders of their weights, beginning with hydrogen, the lightest, as number one. This number of an element is called its atomic number. Many elements consist of mixtures of what the chemist calls isotopes. The isotopes of a given element are all the same element, but their atoms have slightly different weights. Dr. Howard has worked out a series of rules by which the isotopes of elements that have not yet been successfully divided may be predicted. These relationships, together with his experimental results, lead Dr. Howard to think that the odd-numbered elements may have actually been formed from the lightest isotopes of the even-numbered elements. According to modern ideas of the structures of the atoms of matter, this could be accomplished by the loss from the first element of a proton to form an atom of hydrogen, while the atom remaining would be that of an odd-numbered element. As the process would be accompanied by the liberation of heat, Dr. Howard thinks that this is sufficient to account for much of the earth's heat.

THE WITTENBERG SYMPOSIUM ON THE FEELINGS AND THE EMOTIONS

The papers by foreign psychologists read at Wittenberg included discussions by Professor E. Claperède, of the University of Geneva; Dr. Alfred Adler, of Vienna, and Professor Henri Pieron, of the University of Paris.

Professor Claperède discussed the theory of emotion advanced by William James some forty years ago to the effect that we do not run away because we are afraid, but that we are afraid because we run, that it is the process of getting ready to run that warns us that we are in danger. The feeling of danger is useful because it urges the man to seek safety. If he can run fast enough, he proceeds to escape without any emotion at all. But if he lacks faith in his legs, his body is thrown into a state

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of excitement as he tries to run and he is made conscious that he is gripped by fear. "Feelings are useful in our conduct, while the emotions serve no purpose," Professor Claperède concludes. "The uselessness, or even the nuisance, of the emotion is known to every one. Here is an individual who would cross the street. If he is afraid of automobiles, he loses his composure and is run over. Sorrow, joy, anger, by enfeebling attention or judgment, often make us commit regrettable acts. In brief, the individual in the grip of an emotion loses his head."

DR. ADLER, speaking on superiority and inferiority, pointed out that from the time of the child's first social contacts with his mother, his aim through life is to overcome difficulties of life and to gain superiority. The mother must try to give the little child freedom to develop his superiority through independence, self-confidence and courage. Later, she must spread the interest of the child to other persons and situations, so that he feels at home in the world. Three types of young children have difficulty in attaining the goal of normal superiority toward which every human being strives: First, children with imperfect organs; they need more time and more effort than others to integrate. Second, spoiled children. They are not free to function alone and develop in the direction of always wishing to be supported. They are attacked on all sides because of this behavior and feel in a hostile environment and therefore under strain. Third, hated children—illegitimate, not wanted, ugly, crippled. They have the same difficulties as the second type, but without the aid of a supporting person. Useless, anti-social activities of problem children, neurotics, criminals, suicides, sexual perverts and prostitutes are caused by a lack in social feeling, courage and self-confidence.

AN example of how emotions bring about intense unusual activity in animals was given by Professor Pieron. A crab fettered by one claw and left with food just out of reach will resignedly starve to death. But put a polyp, the crab's most deadly enemy, nearby, and the prisoner crab will be convulsed with fear. Excitement racing through its nerves will send a violent shock to the tied claw and the claw will come off, so that the crab can scuttle off to safety. From the amoeba, one of the simplest, tiniest forms of animal life, up to man, action is always guided by feelings. Even purely mental action in man, which we call thought, is regulated by his state of feeling. If the feelings become sufficiently intense so that there is an abnormal discharge of nervous energy, the emotional stage is reached. In emergencies, this nervous energy gives the animal or man greater power to fight or flee. But the after-effect is nervous exhaustion and temporary disorganization of the body machinery. In a man, if he is highly emotional and if he is not well balanced, the emergency reserve of energy may be a source of real danger, "like large ponds, established along a watercourse, which accumulates the available energy and may cause disastrous inundations if the barriers give way before a sudden onslaught. In the animal world as among men, emotions sometimes lead to useless outbursts of activity. An ant, coming upon a spot of soil near its nest which has been saturated with the odor of foreign ants, sometimes begins to strike the ground violently with its mandibles, instead of being content to flee or to explore carefully the neighborhood of the suspicious place."

ITEMS

A PAPER giving the results of a series of lighting experiments made by C. E. Ferree and Gertrude Rand, of Bryn Mawr College, was read before the joint session of the annual conventions of the National Committee for the Prevention of Blindness and the Illuminating Engineering Society. A number of factory workers were tested for the quickness with which they could see details in terms of black and white. It was found that whether the object is white against a black background, or *vice versa*, there is a rapid increase of speed as the amount of light is increased, up to 15 or 20-foot candles. While there is no way of measuring a man's eye-strain, the tests prove that eye-strain may be lessened greatly by increasing the light to the point where the eye will work at its optimum speed.

RABIES is one of the most important of the country's health problems in the estimation of Dr. Thurman B. Rice, of the Indiana University School of Medicine. Speaking at the American Public Health Association, Dr. Rice stated that rabies is increasing and, while the number of deaths is not large, the suffering and fear it causes are so great that they make it the most dreaded of all diseases. There is very little rabies in northern states and in Canada, but in the southern states and in the middle west the disease is on the increase. A survey of conditions in European and South American countries shows that in sections where dog quarantines and muzzling ordinances are prevalent and strictly enforced rabies can be stamped out.

DR. KARL EDEN has just completed a statistical study in Stockholm that shows that the birth rate of the laboring classes is about 35 per cent. below that of the more affluent strata of society. Stockholm laborers are apparently willing to let their earnings determine the number of their progeny, a state of affairs in marked contrast to that which obtains in almost every country in which statistical surveys have been made. The so-called upper classes are usually the ones that limit the size of their families.

CANE CREAM, a new sugar by-product developed by the Bureau of Chemistry, has proved to be such a popular delicacy in the South that the government is now introducing it to northern cookery experts. A deep brown in color, the new offering is more or less of a medium in flavor between the Canadian maple cream, a thick spread made from maple-sugar, and the molasses syrup popular for use on pancakes. Experts claim the flavor retains to an unusual degree the taste of the original sugar juice. Whereas molasses is the juice remaining after the making of sugar by crystallization of the cane sap, cane cream is the whole juice—thick, creamy and syrupy.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE MEXICAN BEAN BEETLE

FOR the first time in its history as a pest, the Mexican bean beetle has passed the natural barrier of the Appalachians, providing a serious and immediate threat to the Piedmont and coastal plain regions.

The insect's spread this year, according to the U. S. Bureau of Entomology, has been greater than since its initial eastern appearance in northern Alabama in 1920, when it began an alarming, fast-moving migration northward and eastward.

While this year the destroyer has made few serious inroads into the South, it has overrun the greater part of Maryland and Virginia for the first time and spread 105 miles eastward, reaching North Carolina. The states of New York and Michigan were also invaded for the first time, the former in the southwestern corner and the latter in the southeastern corner. In Pennsylvania, virtually a third of the entire state suffered depredations, notably the section from Tioga City to Lancaster County. This summer's spread is attributed partly to the mild, cool weather, favorable for the development of the larvae.

Besides the common garden bean, the insect attacks the pole bean and the pole lima. Thus far it is not a destroyer to any degree of the soy bean and the cow pea, except in instances where the hungry hordes run short of their favorite beans.

Government control methods have included the introduction of parasite flies from Mexico and the use of arsenated sprays and dusts. This year one of the tiny tachinid flies was introduced, but soon was abandoned, partly because of inadequate knowledge of the insect's life cycle and because indications were that the Mexican bean beetle has virtually no natural enemy important enough to really check its multiplication. Moreover, adult parasite flies tend not to survive our rigorous winters.

Magnesium and calcium arsenate compounds are being used widely as control measures. Fortunately, unlike the wily Japanese beetle, the Mexican beetle needs no lure to persuade him to eat plants containing death-dealing poisons. Meanwhile government technicians are seeking control methods less poisononus and laborious than dusting and spraying.

THE EFFECT OF ALCOHOL ON RATS

SCIENCE is doing its l to ascertain the effects of alcohol on the living syst Dr. Frank Blair Hanson, assisted by Miss Florence eys, of Washington University, has been conducting a alcoholic experiment with ten generations of white ats that if translated into human years and generations would have covered a period of approximately 500 years.

The rats, all descendants of a single pair of identical ancestry, were divided into two groups. One set was kept under normal laboratory conditions while the others, beginning at 20 days of age, were put into an air-tight fume tank over evaporating alcohol. They were left in this alcohol-saturated atmosphere until they were all completely "drunk."

"The first effect of the alcohol," says Dr. Hanson in a report of the experiment that will appear in a forthcoming issue of *The Journal of Heredity*, "was to stimulate the rats to great activity. This exhilaration soon passed, however, and was followed by a period of sullenness and quarrelsomeness. The last period of the treatment was characterized by increasing drowsiness ending in unconsciousness. At this point the rats were removed from the tanks. It often took several hours for the animals to sleep off the effects of the intoxication.

"The direct effects of the alcohol was disastrous in the extreme. The rate of growth was considerably slower in the alcoholic rats than in their untreated brothers and sisters. There were cases of paralysis and gross tremors. The normally white, well-groomed coats of the animals became discolored and unkempt. In appearance they were thoroughly degenerate.

"The eyes of the treated animals exhibited the most striking abnormalities. After only a few treatments many of them became totally blind. By the time the alcoholic rats were mature and mated nearly all were blind."

But of the 1,688 young born to the alcoholic parents throughout the ten generations only one was born with defective eyes, while among the control animals two defective-eyed animals appeared. Descendants of the blind rat of alcoholic ancestry had normal eyes indicating that alcohol is powerless to induce hereditary eye defects in the white rat at least. A small proportion of the descendants of the blind rats of control group had defective eyes.

"It seems," said Dr. Hanson, "that in almost any species a certain small percentage of defective individuals will be produced. In order to demonstrate the inheritance of induced eye defects or other abnormalities it will be necessary first to know the normal rate of production of spontaneous defects in the stock employed and then significantly modify that rate by alcohol or other deleterious agent."

SCIENTIFIC TRAINING FOR DENTISTS

LOOKING forward to better and more lasting teeth for future generations, Dr. Henry L. Banzhaf, of Milwaukee, Wis., president of the American Dental Association holding its annual meeting at Detroit, declared that dentistry should be put on a sounder research basis.

"Upon the development of research depends the future progress of our profession," Dr. Banzhaf said. "The reason that there are not more persons who have the training and inclination to do research work lies in the fact that the dental schools have either neglected graduate work entirely or have confined their interest along

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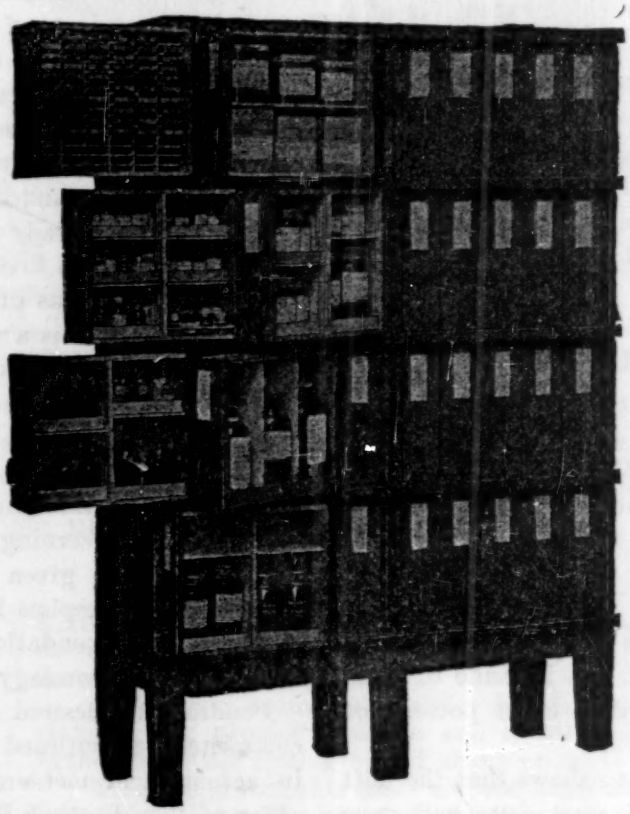

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"Until graduate and research work in our dental schools is organized on a proper logical, scholastic basis, we have little to hope for in research at these institutions. Indications, however, point to an early recognition of this deficiency on the part of universities conducting dental schools and the not distant future will see many of our educational institutions reorganized for graduate instruction in dentistry and provided with adequate funds, just as they are already organized and provided for in other branches of learning."

Dr. Banzhaf commended the recent bulletin issued by the Carnegie Foundation of which he said: "The effect of the study of dental education by the Carnegie Foundation which was recently published is already a foregone conclusion. The *Bulletin* will do much to impress the importance of dental schools upon the chief executives and regents of certain universities who have not yet realized the true significance of dentistry as an essential part of health service. It will also stress the need of dental schools in the appreciation of those citizens who are philanthropically inclined and who desire to donate funds for the purpose of aiding dental education. Last year contributions to medical schools amounted to $100,000,000."

POTTERY FROM TLAXCALA

AMONG the most beautiful pottery made by people in America before the coming of the Spaniards is the pottery of Tlaxcala, in Mexico, says Dr. Eduardo Noguera, of the Mexican department of archeology. Dr. Noguera, who has been excavating an Aztec temple near the town of Tlaxcala, has found a number of specimens of the ceramic art of that race.

The typical Tlaxcala pottery is distinguished by its extreme hardness and its red color. It is made of well-mixed clay and is better baked than most pottery of other regions, he said.

The Mexico City museum collection shows that the deft Tlaxcalan potter made plates and cups, pots and pans with supports, jugs with handles and bowls and dishes with almost flat bottoms, and cups with snouts. There are some vessels in the form of the human foot and others in the shape of various animals.

Most of the pieces have red or yellow foundations upon which are painted designs in yellow, red, white, gray or black. Pyramid figures are common symbols used in the decoration and there are also human figures, emblems of gods, men, animals, plants and portions of the anatomy such as hands, skulls and hearts. The patterns are highly conventionalized and show easy skill.

Some of the vessels are embossed with human or animal heads which serve as handles. Grotesque heads of humans, birds or snakes are used as the feet of vessels.

The Tlaxcalan pottery appears to be a link between the ceramic art of the Mayas of the south and the races further north, Dr. Noguera says. Examples of Tlaxcalan pottery are found so widely scattered over distant parts of Mexico that it is thought that it was valued highly for its beauty and perhaps served as a medium of exchange.

AVIATION WEATHER PROBLEMS

AVIATION'S rapid advance has created such a demand for weather information and research upon the weather hazards of flying that a committee of meteorologists is now considering how flying can be better served by the science of meteorology.

The committee is sponsored by the Daniel Guggenheim Fund for the Promotion of Aeronautics and is headed by a young Swedish meteorologist, Carl-Gustaf Rossby, who has been carrying on special researches in this country. The other members, who represent branches of the United States Government concerned with aeronautics, are Willis R. Gregg, of the Weather Bureau; Thomas H. Chapman, of the Department of Commerce; Major William R. Blair, Signal Corps, U. S. Army, and Lieutenant Francis W. Reichelderfer, Bureau of Aeronautics, Navy Department. The committee has its headquarters at the Weather Bureau, in Washington.

Though it has existed only since the end of July, the committee has already embarked energetically upon its duties. One of its first steps was to undertake a survey of the present status of meteorological instruction in the United States. It is a well-known fact that the tendency of educational institutions in this country has been to slight meteorology. The relatively few courses offered in this subject deal, as a rule, with its superficial aspects rather than with fundamentals. The committee recently addressed a questionnaire to leading universities and technical schools concerning the amount and character of the instruction now given in this field. As soon as an analysis of the replies has been made the committee will draw up recommendations looking to the more adequate teaching of meteorology in American institutions.

Pending the desired improvements in this respect, the committee has outlined a plan for courses of instruction in aeronautical meteorology to be given at the central office of the Weather Bureau. If this plan receives official approval, a number of the younger employees of the bureau, who have had sufficient preliminary education, will be assigned to attend the classes, and it is likely that qualified persons not connected with the bureau will also be permitted to attend. A tentative program of courses has already been drawn up.

On recommendation of the committee the Guggenheim Fund has made a grant to cover the cost of preparing a report on existing knowledge of fog and haze, especially as bearing on the prediction of these conditions for the benefit of aviators. H. C. Willett, of the Weather Bureau, will be sent abroad for a year to prepare the report, and will spend about half of the period at the Geophysical Institute, Bergen, Norway.

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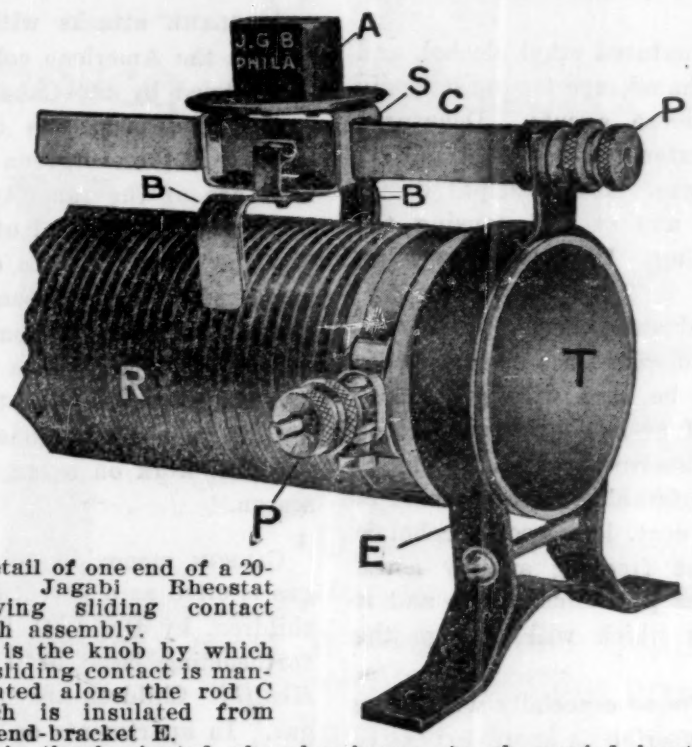

Detail of one end of a 20-inch Jagabi Rheostat showing sliding contact brush assembly.

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ANTI-FREEZE MIXTURES FOR AUTOMOBILES

WHAT to place in auto radiators to keep them from freezing is the problem that auto owners must now consider. Freezing nights will soon be here. Shall it be alcohol, glycerine, glycol, chlorides or some other suggested chemical? Careful studies of the advantages and disadvantages of the anti-freeze solutions suggested have been made by experts.

The two common alcohols, denatured ethyl alcohol, and poisonous wood alcohol or methanol, are the most easily available and cheapest anti-freeze agents. Denatured ethyl alcohol is used to the extent of some 40 million gallons a year as an anti-freeze. Its principal disadvantage is that it evaporates and is lost, causing the radiator to need constant refilling. Its cheapness makes up for this waste.

There is one important disadvantage common to both alcohols. When cars are finished with Duco or some other cellulose lacquer, alcohol must be used with great care or not at all as the spilling of even a small amount of alcohol radiator solution will dissolve and ruin the finish. Denatured alcohol is usually preferable to wood alcohol in spite of the fact that 10 per cent. less wood alcohol is required for protection against freezing at any given temperature. Wood alcohol has poisonous fumes and it sometimes contains free acids which will damage the radiator.

Glycerine is a favorite anti-freeze especially with those who have lacquered cars. Glycerine is more expensive than alcohol, but it does not evaporate very readily and one filling of the radiator should last a whole season if the radiator is free from leaks. Either the colorless chemically pure glycerine or the yellow distilled commercial grade can be used with safety, but the crude product is dangerous because it usually contains salts that corrode the radiator.

When placing either alcohol or glycerine in the radiator do not fill it above two inches from the top of the overflow pipe since the solution will expand when the radiator warms up. Mixtures of alcohol and glycerine are often used as a compromise between the cost of glycerine and the volatility of alcohol.

A relatively new anti-freeze compound that is beginning to be available in sufficient quantity is the chemical, ethylene glycol, made synthetically from petroleum. It has advantages of both alcohol and glycerine and costs about as much as glycerine. It does not affect lacquer finishes, flows easily, does not evaporate and lowers the freezing-point of the solution more effectively than alcohol. It is considered by some chemists to be an ideal anti-freeze compound.

Calcium and magnesium chlorides have been widely sold under trade names as anti-freeze compounds. Their serious disadvantage is that they corrode and cause serious damage to the engine jacket and radiator, particularly aluminum and solder. A soluble chromate added to them tends to prevent this corrosive effect except upon aluminum and this chemical is contained in some of the salt mixtures on sale.

Sugar, honey and glucose are condemned on the grounds that they do not lower the freezing-point sufficiently and are too viscous. Lubricating oil is also ineffective as a radiator solution because of its low heat capacity and high viscosity, while kerosene is dangerous due to inflammability, danger of overheating and its solvent action on rubber.

ITEMS

AIRPLANE attacks with poison dust, similar to those used in the American cotton belt against boll weevil, are being tried by the Canadian forest service to check the spruce budworm, one of the most formidable insect enemies of the evergreen forests of the West. The planes used are of the same type as those used in the cotton work, and the method of attack is similar. The aviator flies low over the tops of the trees, and releases finely powdered calcium arsenate and lead arsenate from a hopper. The wind from the propeller swirls the poison dust out into a swath a hundred feet wide, which settles into the trees and gives the foliage a thin protective coat. If this year's tests show the method to be economically feasible, work on a larger scale will be undertaken next season.

CARBON monoxide poisoning from automobile exhaust gas is cited as a potential factor in the ill health of city children, by Dr. J. C. Sinclair Battley, of Detroit, in a forthcoming issue of *The American Journal of Public Health*. Children are exposed to a great deal of exhaust gas. In apartments on main thoroughfares where traffic is heavy, children are subjected to a constant stream of diluted exhaust gas rising from the lower stories through the building for a considerable part of the day. The poisonous effect is difficult to estimate because of the multiplicity of factors involved, but prolonged observation may bring substantial proof. In view of the fact that chronic poisoning has been observed in adults, there seems no reason why it may not be a factor in the ill health of children.

DRS. J. S. BOLIN AND S. J. HOLMES have examined the records of 2,074 alumnae of the University of California graduated between the years of 1874 and 1910 and in a report shortly to appear in *The Journal of Heredity* they state that of these 1,160 were married and 914 were unmarried, this proportion being roughly the same as that known to obtain in several other colleges and universities. Investigation of the scholarship records showed that contrary to general expectation the grades of the married ranged a shade higher, .008 of a point to be exact, than those of their still unmated sisters. The girls who made the honorary society Phi Beta Kappa, awarded to students of high scholarship, were divided about fifty-fifty among the ranks of the married and the single.

THE American Eugenics Society, in continuation of its policy of showing an eugenics exhibit at state fairs, this year fitted out a Ford truck, purchased an exhibition tent, and employed Mr. William C. Palmer as manager. The exhibit was shown at nine fairs throughout New England.

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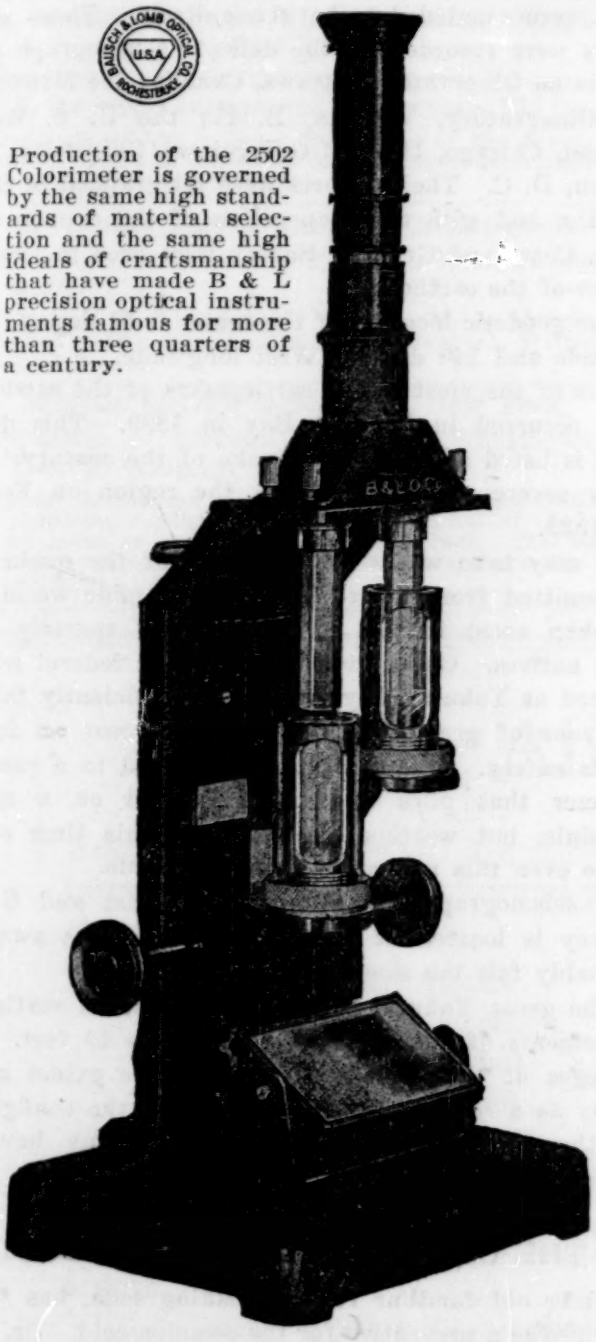

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PONS WINNECKE COMET

DESPITE the excitement it occasioned last summer when it came within 4,000,000 miles of the earth—closer than any previous comet—the Pons Winnecke Comet had the distinction of possessing the smallest nucleus that has ever been observed in such a body. Probably it was not more than two or three miles in diameter. This is announced by Dr. V. M. Slipher, director of the Lowell Observatory at Flagstaff.

Dr. Slipher took advantage of the close visit of Pons Winnecke to watch it carefully with the observatory's big refracting telescope, with a lens two feet in diameter. He had, he says, the best opportunity in years to make a measurement of the size of a comet's nucleus, the center which is supposed to supply the rest of its material. On most occasions "the nucleus of the comet was found to be perfectly stellar, *i.e.*, very small and sharp." At such times "it was possible to distinguish the nucleus from stars only by its motion."

Even through the highest power telescope a star appears as a point of light. First, Dr. Slipher compared the cometary nucleus with nearby stars. Then he took stars of similar brightness in another part of the heavens, near the planet Jupiter, and compared them with the large moon of that planet. As the size and distance of the Jovian moons are known, it was thus possible to estimate the size of the nucleus. Its distance from the earth was also known, and thus it was possible to get a rough approximation of its diameter. This, he found, was not more than two or three miles.

Other studies of the comet were made by Dr. Slipher with the aid of a spectroscope attached to the big telescope. In this way, by analyzing its light, he found several very peculiar features. It has been supposed that comets are excited to great activity as they get near the sun, but the studies of Dr. Slipher of Pons Winnecke as well as other comets, seems to contradict these views.

The spectrum showed very strongly the same dark bands that are revealed in the spectrum of the sun. This shows that the comet's light consisted largely of reflected sunlight. Also, in the band of spectrum there appeared rather weakly the bands that are associated with cometary light. A spray of light which projected from the nucleus towards the sun gave off more light of its own than any other part of the comet.

Besides having its activity reduced by approach to the sun, Dr. Slipher believes that its close approach to the earth may have also reduced the comet's light. In 1910, he said, it was found that the light emissions from Halley's Comet were reduced as it approached the earth, and they became more intense as it drew away. Previously, it has been supposed that the earth has little influence on the activity of comets coming near it. If this is the case, it would account for the fact that Pons Winnecke, despite its close approach to the earth, was much fainter than some astronomers had anticipated.

AN EARTHQUAKE IN ALASKA

AN earthquake of severe intensity shook an area on the Alaska-Canada boundary, about 75 miles north of coast of Yakutat Bay, a region of mountains and wilderness. The exact time of the shock was Monday, October 24, at 10:59½ a m. (Eastern Standard Time).

News of this earth disturbance was brought to civilization through the vibrations within the earth's crust that were created by the shock itself. These seismic waves were recorded on the delicate seismograph at the Dominion Observatory, Ottawa, Canada; the Meteorological Observatory, Victoria, B. C.; the U. S. Weather Bureau, Chicago, Ill., and Georgetown University, Washington, D. C. Their reports were telegraphed to Science Service, and with the cooperation of the experts of the U. S. Coast and Geodetic Survey were used to locate the center of the earthquake.

The geodetic location of the center is 61 degrees North latitude and 140 degrees West longitude.

One of the most severe earthquakes of the earth's history occurred in Yakutat Bay in 1899. This disturbance is listed as "the earthquake of the century." Another severe earthquake shook the region on February 21, 1925.

It may take weeks for the news of the quake to be transmitted from the region to the outside world. The Alaskan coast in this locality is only sparsely settled with natives. One native village and a federal school is located at Yakutat Bay, but this is sufficiently far from the zone of greatest disturbance to arouse no fears as to its safety. Communication is limited to a coast-wise steamer that plies as far as Seward on a monthly schedule, but weather conditions at this time of year make even this meager contact unreliable.

A seismographic station of the Coast and Geodetic Survey is located at Sitka, some 300 miles away, and probably felt the shock.

The great Yakutat shock of 1899 caused vertical displacements of the earth of as much as 40 feet. While changes of the earth's surface of this extent are not likely as a result of the present shock, the configuration of the ocean bottom in that region may have been changed causing navigation to be menaced.

THE CAUSE OF THE COMMON COLD

THAT old familiar remedy, baking soda, has found a new use as a preventive for the common cold. Dr. Volney S. Cheney, medical director in one of the large packing firms of this city, has reported to the American Public Health Association.

Eleven years spent in an exhaustive study of colds have convinced Dr. Cheney that this too common malady is not infectious, as is commonly believed, but that the organisms usually regarded as the causative factor in colds are only secondary invaders in the latter stage.

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The primary cause he ascribed to be a condition of mild acidosis that is brought about by too much protein in the diet, lack of exercise and infections already present anywhere in the body. Dr. Cheney maintained that colds can be prevented and even cured by keeping an alkaline balance in the body through proper diet and carefully regulated doses of sodium bicarbonate or alkaline waters along with small quantities of calcidin and iodin.

"My experience of many years," said Dr. Cheney, "among the aborigines of the Southwest convinces me that colds, as we know them, are a product of civilization."

The infectious origin of a cold is only an unproved theory, and a theory based upon a false premise because in the early stages of a cold the secretions, from the nose particularly, are frequently sterile and the organisms usually regarded as being the causative factor are only secondary invaders of the latter stages.

Climatic variations are a contributing factor only so far as they inhibit our normal activities and decrease our utilization of protein foods which are always in excess of what we normally require. We eat too much and exercise too little in cold weather. Colds are less frequent in warm weather because we eat less of high protein foods and exercise more.

"The time of greatest incidence of colds in our industry is on a Monday and days following holidays, and also days following banquets or parties where there is an abundance of good things to eat. I have also observed that colds are very prevalent in our traveling salesmen or men who are on the road a great deal. After these trips, upon inquiry, I have ascertained that always while traveling there has been a decided change in the daily routine compared to the one they maintain while at home; a proneness to overeating of high protein foods and sometimes overdrinking of alcoholic stimulants; increased mental strain; lack of proper exercise and loss of sleep. Statistics show that about 45 per cent. of absenteeism in most of our large industries is caused by colds or their after-effects."

IMPROVED FRUITS

THANKS to tin cans and fruit breeding experiments, inhabitants of the United States should not lack for fruit any month of the year.

Apples that will bear the year after planting, strawberries all the year around and raspberries that will grow in the South, where raspberries have been conspicuous by their absence, are recent fruit achievements described by George M. Darrow, of the U. S. Bureau of Plant Industry, in a report on fruit breeding to appear in a forthcoming issue of *The Journal of Heredity*.

Several varieties of plum have been developed at the South Dakota Experiment Station that will grow in the Upper Mississippi Valley, where little or no fruit of this sort would flourish before. A blight-resistant, hardy pear has been produced that shows great promise in this same region. The season of the McIntosh apple has been extended so that variations of this well-loved variety are available through several months of the year. Best of all, the U. S. Department of Agriculture has to its credit a bush cherry bearing delicious fruit that is a partial realization of the pomologists' dream of achieving a sweet cherry that will grow wherever sour cherries are hardy.

Of the hundreds of new fruit varieties introduced by experiment stations several have attained an outstanding commercial position. Prominent among these is a red raspberry, known as the Latham, developed from a cross made at the Minnesota Experiment Station in 1908. It was introduced in 1914 and is now cultivated throughout many eastern and northern states.

In 1926, it is stated, the income derived by Minnesota growers was more than four times the total amount expended by the state on the fruit-breeding farm since it was established in 1908.

NEW POTATO DISEASES

Two new and mysterious potato diseases, one causing midgets and the other making a broom-shaped aerial monstrosity, have reached the critical attention of government potato experts.

Both diseases are problematical in origin and serious in their potentialities. The English science defier, dubbed "leaf-curl" in the mother land, has the puzzling habit of throwing the plants' vitality into weedy stalk growth, the while robbing the tubers of their normal size and strength. Hundreds of acres in Lancashire have been devastated by the disease, though its existence has not been announced in America.

The other, a product of Utah, resembles that other peculiar potato disease, "witches' broom." The latter causes unduly numerous but poorly grown stalks, the upper plant actually resembling the conventional conception of a witch's broom. Small or "aerial" tubers thrive on the plant above the ground. They are squashily pulpy, sometimes are no bigger than a man's thumb, and have an unhealthy greenish shade. Plants affected extremely early in their development sometimes fail altogether to produce tubers.

The American disease affects both the early and the late crops, though the infestation is generally less heavy and somewhat severe in the latter case. Experiments indicate that the outbreak of the disease has no association with the source of seed potatoes, making it apparent that some other agency is responsible. Early in the field study of the disease an apparently new kind of insect was noted on affected plants.

Concerning the English monstrosity, Dr. Freeman Weiss, potato expert of the U. S. Department of Agriculture, will make no definite statement until more complete facts are forwarded. However, he points out that the disease may be synonymous with the common "leaf roll" in America, which shows somewhat similar symptoms. Moreover, the English term "leaf curl" is virtually obsolete in this country, though it was once used to designate many potato irregularities, some complex and some simple. It is likewise possible, Dr. Weiss points out, that climate and soil conditions may have produced the freakish tubers.

CRIME DETECTION METHODS

PRESENT methods for utilizing scientific knowledge in attempts to solve medicolegal problems, such as cases of

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THE INTERDEPENDENCE OF SCIENCE AND MEDICINE. The Late Lord Lister.
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MYSTERY MONUMENTS OF THE MARIANAS. Lieutenant-Commander P. J. Searles.
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TROPICAL CLIMATOLOGY. Dr. Alfred C. Reed.
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THE ACTION OF ALCOHOL ON THE BODY AND ON ITS OUTPUT OF WORK. Dr. J. Frank Daniel.
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doubtful paternity, murder and the like, are inadequate in this country, in the estimation of Dr. Ludvig Hektoen, director of the John McCormick Institute for Infectious Diseases, who has devoted considerable attention to the study of forensic medicine.

Dr. Hektoen believes that before society can reap anything like full benefit from the advances of science in this direction there will have to be great improvement in medicolegal organization and equipment throughout the country.

Under the archaic system of county coroner, he explained, which still prevails in most states, the routine medicolegal work is entrusted for the most part to political hangers-on who have not the required fitness or interest for their task. The standards of post-mortem examination and records in most places are disgracefully low. There has been and is a lack of interest on the part of officials, physicians and lawyers in building up the various departments of forensic medicine which consequently falls far short of its possible social value.

With the single exception of the Massachusetts Medico-Legal Society and its journal, we have no societies or periodicals of any consequence devoted to medicolegal practice and research. In the medical schools the formal teaching in this field is perfunctory and as a rule wholly didactic; as yet no effort has been made in any of our universities to coordinate and develop actively the medicolegal instruction in their schools of law and medicine. There is in this whole country not a single, fully equipped and adequately manned medicolegal institution. But our medicolegal problems are not falling off in number or importance and there is increasing need for better medicolegal work and for a more active development of forensic medicine in the United States.

To stimulate interest and research in medicolegal problems and to raise the standards of practical medicolegal work, there is needed, it seems to me, an organization of national scope to include all the various phases of forensic medicine, and there will be needed also perhaps increased facilities for publication. It is encouraging that the American Medical Association is planning to introduce a session on medicolegal topics in one of its sections. Owing to constant progress in the contributing sciences there is particular and continuous need of integrating these various branches in their medicolegal relations. The situation demands not only replacement of the coroner system by one far more effective, such as the Massachusetts system, but also the establishment of fully equipped medicolegal departments or institutes designed to meet the needs of city and state.

ITEMS

BURNING sulphur deposits on the shore of the Dead Sea may have been responsible for the strange luminous fog that swept over Jerusalem a few nights ago and caused a two-hour period of choking discomfort to the inhabitants. This opinion was hazarded by Dr. Immanuel Friedlaender, a European student of volcanic phenomena, founder and director of the Volcanological Institute at Naples. There is little likelihood of the sulphurous mist having come from a volcanic source, for though the region was once volcanic there have been no eruptions within historic time. However, there are large exposed deposits of sulphur around the Dead Sea, which have long been pointed out as part of the brimstone from heaven that destroyed Sodom and Gomorrah. Since Jerusalem is only fifteen miles west from northern end of this great salt lake, a fire accidentally started on the sulphur beds when the wind was blowing toward the city could easily give rise to fumes of sufficient strength to be distinctly disagreeable to its inhabitants.

SMOKE in its relationship to pneumonia, the most prevalent and fatal of all acute infectious diseases, was discussed in a recent report by Dr. W. C. White and the U. S. Public Health Service to the American Society of Mechanical Engineers. The fact that Pittsburgh, one of the smokiest cities, has the highest constant death rate of any community in the world, and that the pneumonia death rate of the city by wards is higher where the smoke content of the air is densest, indicates that smoke has a large influence on this disease. Definite proof of this correlation is still lacking. Further research in the field is necessary, with doctors and engineers cooperating, to determine the effect of smoke upon health. Dusts associated with carbon in smoke are probably much more important than the carbon. It is probable that smoke has an evil influence on the prevalence of pneumonia, but that it bears no relation to the tuberculosis death rate or to the death rate from cancer. Pittsburgh has a low tuberculosis death rate and a comparatively low death rate from cancer.

THAT absolute alcohol by the gallon should be kept on hand in chemical plants as a remedy for burns is recommended by a German chemist, according to a report to the American Chemical Society. Pure alcohol has been found to be a particularly efficacious treatment for the severe burns that result from contact with sulphuric acid and other strong reagents used in industrial chemical processes. The quicker the cases are treated the more effective are the results. Blisters never develop, it is said. Due consideration must, of course, be given to possible risk from the inflammability of alcohol.

The problem that immune carriers of virulent diphtheria germs present to the community has been met by Dr. E. H. R. Harries, medical superintendent of Birmingham City Hospital, by the procedure of removing the tonsils of the innocent offenders. Ordinary gargling and swabbing with antiseptic and germicidal preparations have little effect on the diphtheria bacilli in such cases. Diphtheria vaccines have likewise been found useless. While such carriers are not common, the ones that do exist present a serious menace to susceptible children. Consequently, Dr. Harries and his associates decided to try out the idea of removing their tonsils, the principal site where the deadly bacilli accumulate. In a series of 90 cases only one was found responsible for a return case of diphtheria and the responsibility for this was open to doubt. While the method is not the ideal way to contend with this problem in public health, Dr. Harries believes it to be a rational and successful one.

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SCIENCE NEWS

Science Service, Washington, D. C.

OCEAN CANYONS

THE depths of the ocean will be explored if a great cooperative plan just proposed by the International and Geodetic and Geophysical Union takes its expected practical turn. Scientists of 25 nations, meeting at Prague, have passed resolutions recommending an international cooperative study of "ocean deeps," according to the U. S. Coast and Geodetic Survey.

"Ocean deeps," or "ocean canyons," are known to scientists as "the earth's last frontier," because man has not, until recently, devised instruments which to any degree of accuracy could measure their vastness. Even a visualization of the Grand Canyon of the Colorado dwindles into insignificance when compared with the gigantic size of the ocean canyons. The Grand Canyon stretches one mile deep and some 10 miles wide, while the "deeps" at times are at least three miles below the ocean's so-called bottom and a score or so miles in breadth.

Among the best known "ocean canyons" are: one on the west coast of Mexico, stretching some 40 miles wide and an indeterminate distance in length; one off the Aleutian Islands of southeastern Alaska; one off the coast of Java, recently explored to some extent by the Dutch Government, and others off the coasts of Japan and the Philippines.

Scientific men have labored under handicaps in their efforts to explore the ocean substrata. It has been impossible to send submarines into the treacherous watery depths because the pressure would crush the craft's heavy metal as rapidly, perhaps, as an egg-shell crumbles in the hand. The usual procedure has been to make soundings by means of leads attached to heavy piano wire. However, to let out some six miles of wire and pull it to the surface again has proved to be a task, taking ordinarily at least an hour's time. Moreover, hundreds of soundings must be taken in this laborious fashion in a limited area before scientists may gain anything approximating a genuine idea of the "deep's" configuration.

Fortunately, a sounding device developed recently has given promise that knowledge of these "deeps" soon will be more than a scientific dream. The contrivance is now being used by the U. S. Coast and Geodetic Survey in its work. It operates on the "echo principle," based on the rate of speed at which sound travels. The rate being known, the machine makes it possible to compute the depth. Thus thousands of soundings may be taken in a comparatively short time—and while the ship is moving ahead at full speed. In conjunction with this method the old method still is used, primarily, however, for the purpose of bringing up specimens of the ocean's bottom, revealing the character of the crustal material.

Scientists believe an extensive international cooperative study of "ocean canyons" might reveal important facts about earthquakes, three fourths of which have their origin in the sea. In this respect, a particularly fertile source is the Pacific Ocean, notably off the coast of earthquake-swept Japan. There is the possibility, moreover, that some undersea volcanoes, unknown as yet to science, may be brought to light. Again, while no definite attempt is planned for the study of undersea fauna and flora, facts of great value to oceanographers may be disclosed.

"NEBULIUM"

NEBULIUM, the strange "element" that has been supposed to exist in such bodies as the great cloud of glowing gas in the star group of Orion, seems to be nothing but oxygen and nitrogen, of which we take in about a pint every time we breathe. This is the opinion of I. S. Bowen, of the Norman Bridge Laboratory of Physics.

Following the discovery of helium, first as a strange line in the spectrum of the sun, and then as an actual element on the earth, a mysterious group of lines was found in the spectrum of some of the nebulae. As most of the spectral lines are known to be due to certain elements, it was thought that the strange lines, of which one was green, might be due to an element as yet undiscovered.

Dr. Bowen's studies now indicate, however, that these lines are due at least partly to oxygen and nitrogen, of which the air is chiefly composed, but in what is termed the "metastable state." While in the laboratory atoms of certain gases can be induced to enter this state, they ordinarily return to the normal condition without giving off light, by bumping into another atom or the walls of the tube. In the nebula, however, the pressure is very low, probably much lower than the lowest terrestrial vacuum, which means that the atoms are not so crowded. They are therefore less apt to bump into each other, and the walls of the tube are absent. The result is that the atoms remain longer in the metastable state and finally return to normal condition spontaneously. According to Dr. Bowen's calculations, if this happened, light would be given off of the same wave-lengths as the mysterious nebulium lines.

Dr. Bowen reported his conclusions recently to *Nature*. In a later issue, Professor A. Fowler, a leading English authority on the subject, states that the evidence, on the whole, "appears to be in favor of Mr. Bowen's suggestions." He also suggests that one of the lines, in the part of the spectrum just beyond the red end, should be accompanied by a fainter line, on the side towards the visible spectrum. If astronomers can discover this in the spectrum photographs of the nebulae, it would be strong evidence in favor of Dr. Bowen's views.

YELLOW FEVER IN AFRICA

DR. HIDEYO NOGUCHI, the well-known bacteriologist of the Rockefeller Institute for Medical Research, is *en route* for Lagos, Nigeria, to investigate the yellow fever that has been prevalent on the west coast of Africa for several months.

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Dr. Noguchi will work in collaboration with the staff of the International Health Division of the Rockefeller Foundation at Lagos, which has been working on the African yellow fever problem for some time. It is due to the efforts of the International Health Board that this once widely-distributed disease has been almost entirely eliminated in the western hemisphere except for isolated cases in the interior of Brazil and other countries of South America. Every effort is being made to stamp out the fatal insect-borne malady before it gains a wider foothold in Africa or can spread to the Orient.

Dr. Noguchi already has to his credit a preventive vaccine and a curative serum for yellow fever developed in the laboratories of the Rockefeller Institute several years ago. According to reports received by the French Academy of Medicine, this treatment was used with considerable success in an outbreak in Senegal during the past summer.

On account of the lack of transportation and other difficulties in the way of carrying out a scientific program of disease control in a primitive tropical country, the work of the International Health Board has been confined to the British colonies of Nigeria and the Gold Coast. Scientists hope these researches will lead to new light on this highly fatal disease that will eventually bring about its eradication from the face of the globe.

On his return trip, Dr. Noguchi expects to visit Egypt to study trachoma, a disease of the eye, widely prevalent there. What is believed to be the causative organism of this eye infection was recently isolated by Dr. Noguchi from the eye of an American Indian, a race in which trachoma is commonly found in this country.

HANDICAPS OF FIRST-BORN CHILDREN

TIME was when being your parent's first-born child, if you were a boy, was an immense asset from a worldly point of view. Now comes Dr. G. F. Still, professor of children's diseases at King's College, with a statistical study that shows that the first birth, more than any subsequent ones, carries with it a definite physiological risk of congenital malformations of the mind or body.

The most prominent defect he has found associated with first-born children is known technically as hypertrophy of the pylorus, too large a development of the muscle that controls the departure of digesting food from the stomach into the intestine. The proportion of first children among 400 cases afflicted with this trouble runs as high as 48.5 per cent. Dr. Still also mentions pneumonia and congenital heart disease as claiming a large number of victims among those who came first in the family.

Place-in-family as a factor in the causation of disease is thought to be due to certain affections that come from perversion of development during the prenatal period with the first child.

The practical applications of this research are pointed out by Dr. Still, who states: "It is no small thing if we can give comfort and hope to the mother and father who are faced with disaster in their first-born, in the shape of some congenital abnormality of mind or body. They are apt to imagine that this is due to some fault or failing which will mar the rest of their married life by likelihood of repetition of disaster if they have further children. It is something to be able to tell them that primogeniture itself is a large factor, possibly the only factor in the production of their misfortune, and that it is therefore highly improbable that any subsequent child will suffer from any congenital anomaly, as indeed experience shows, for the repetition of congenital anomalies in a family, though by no means unknown, is very exceptional."

THE NEANDERTHAL MAN

THAT Neanderthal man was a direct ancestor of modern man, and not merely a side shoot from the evolutionary stem, is held out as a definite scientific possibility by Dr. Aleš Hrdlička, the American anthropologist. Speaking on the occasion of the award to him of the Huxley Memorial Medal of the Royal Anthropological Society on November 9, Dr. Hrdlička called in question the widely accepted belief that this ancient, low-browed race was a people apart from modern humanity, and was entirely exterminated by an invasion of the early Cro-Magnon race, leaving no descendants.

While emphasizing the necessity for much further excavations and search for materials to supplement the present collections of skulls, bones and implements, Dr. Hrdlička indicated that even the fragmentary data now in hand suffice to cast considerable doubt on present widely accepted theories.

In geological sequence, in his relation to the animals among which he lived and which supplied his food, in his choice and use of shelters and caves, in his art and implements, and above all in his bodily structure, Neanderthal man fits into the evolutionary picture. In his beginnings, he grades off into the little-known races that preceded him, and at his end he grades off similarly into the better-known race that followed.

Even in the crucial matter of skull shape and proportion, Dr. Hrdlička pointed out, Neanderthal man is not so sharply marked off from modern man as we commonly assume. The more typical skulls do display marked characteristics, such as a low, flattened top of the braincase, heavy eyebrow ridges reminiscent of the gorilla, a jaw very massive but lacking in chin, and a very primitive type of teeth. But among the collection can be found skulls that depart from the type. One shows a higher cranial arch, another has eyebrow ridges of a less ape-like type, a third displays a remarkably "human" tendency in the shape of the upper jaw and palate, and so on. These departures from type, Dr. Hrdlička said, indicate that evolution was actively at work in the race, and that it was not a fixed and static type which could not give rise to a new kind of humanity. It would be more proper, in his opinion, to refer to a Neanderthal phase in human development rather than to a Neanderthal species of man.

ANCIENT INHABITANTS OF AMERICA

A LITTLE flint arrow point, such as primitive men used in hunting game, has been accepted by a number of scientists as real evidence that America was inhabited when

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NOVEMBER–DECEMBER

On Endocrines and Organisms. Dr. Oscar Riddle.

The Effects of Alcohol on Birth Weight and Litter Size in the Albino Rat. Professor Frank Blair Hanson and Florence Heys.

A Lethal Mutation in Maize affecting the Seed. Dr. R. A. Brink.

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mammoths and mastodons roamed this country, in the Pleistocene period, at least 15,000 or 20,000 years ago. The arrow point was discovered beside a buffalo skeleton at Folsom, New Mexico, about two months ago, and it has remained untouched while experts on American Indians and experts on geology have visited the scene to express their opinions as to what story it really tells.

This is the first time that a tool used by man has been found beside a prehistoric animal and has remained undisturbed for careful scientific examination, according to Dr. F. H. H. Roberts, Jr., of the Bureau of American Ethnology, who has just returned from investigation of the remarkable discovery.

"It has been said that prairie dogs burrowing into the ground can push an object into old, deep layers of earth, where much older objects lie," said Dr. Roberts. "But in this case there are four distinct layers over the bones of the buffalo and the arrow. There are no prairie dog holes in the vicinity, and the layers are entirely untouched.

"The arrow lies close to a rib bone of the buffalo, in such a way as to indicate that it was in the animal at the time of death."

Four other arrow points were also found and bones of eight buffaloes were counted altogether in the pit, but some of this other material was moved in early scientific study of the site. The buffaloes were apparently caught in a bog while being pursued and sunk there to die.

The arrow points are beautifully chipped, Dr. Roberts reports. A unique feature is a hollow groove down the center of each flint. In the recent war, bayonets were grooved to cause greater bleeding, and it may be that the Stone Age Americans had this same idea.

The first discovery of prehistoric animals at this site was made two years ago by a cattle inspector who was passing the ravine and saw bones sticking out of the bank. He recognized them as buffalo bones and sent specimens to J. D. Figgins at the Museum of Natural History, in Denver. Since then, Mr. Figgins and his assistants have made further discoveries and the site is still considered likely to yield further evidence of the same sort.

"There is no question that the arrow and the buffalo most recently found there came there together," Dr. Roberts concludes. "It remains for the geologists to determine the age of the deposits in which they occur."

Dr. O. P. Hay, paleontologist of the U. S. National Museum, who visited Folsom this summer and has examined some of the prehistoric buffalo bones found there, considers this discovery "one of the most certain pieces of evidence produced that man existed in America in the Pleistocene period." From this and other similar finds Dr. Hay says that it seems impossible to believe that man has been in America only a few thousand years.

The buffalo bones are those of an extinct species, somewhat larger than modern buffaloes, and they may turn out to be a kind different from any heretofore known.

ITEMS

A SCIENTIFIC method of crossing a bridge before you come to it is described by Dr. L. O. Howard, head of the bureau of entomology of the U. S. Department of Agriculture. During his recent trip in Europe, he found in Germany a new and well-equipped laboratory for the study and combat of the European corn borer, which is working costly havoc on the eastern border of the American corn belt. Dr. Howard knew that corn has never been raised in Germany to any extent, and the laboratory seemed to be a sheer case of borrowing trouble. He asked the German scientist who was acting as his guide about it. "No, we do not have much corn as yet," was the answer; "but you see we are about to begin cultivating it on a large scale in this country. Of course, when we do we shall have to contend with the corn borer, and we think it is well to get a head start while we can."

X-RAYS applied to the reproductive cells of plants in the laboratories of the University of California have resulted in the production of many new varieties and in the visible modification of the cell structures responsible for the transmission of hereditary characters in reproduction. The work was done by Professor T. H. Goodspeed of the department of botany, and Professor A. R. Olson of the department of chemistry, using tobacco plants as material. Their results resemble and partly corroborate those recently reported for fruit-flies by Professor H. J. Muller, of the University of Texas. Nearly 1,200 offspring of X-rayed parent plants are now growing in the university's new botanic garden.

THE vexed question whether Neanderthal man appeared in Britain before or after the glacial period is now considered settled in favor of the earlier date, according to J. Reid Moire. Mr. Moire is chairman of a committee of scientists appointed to examine the clay beds at Hoxne, Suffolk, which have yielded large numbers of implements made by Neanderthal man. The structure of the beds as pieced together from many excavations, shows a thick layer of glacial boulder clay, indicating a long period of intense cold, above the stratum in which the most primitive man-made implements of this locality are found. Overlying this glacial layer was a second bed containing stone tools of the Old Stone Age, but of a more advanced type than the first. Then another deposit of the type laid down during cold times, and finally the present ground surface, beneath which were found relics of the New Stone Age. The intervention of two cold-period beds above the level of the earliest implements is regarded as conclusive evidence of glacial man in Britain.

THERE appears to be no lower limit to the descending birth rate of European cities short of absolute zero, according to studies made by Dr. Warren S. Thompson, of the Scripps Foundation for Population Problems. Berlin leads the procession with only 11.7 births per thousand people in 1925 which exceeded only slightly the death rate of 11.4, but the figures available for 1926 indicate that the death rate may have exceeded the birth rate during the last year. As a group the large cities of Germany had a birth rate of only 14.1 in 1926 and the report for the first month of 1927 indicates that for the year it will be even lower.

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW GERMICIDE

A LIQUID germicide, known as S. T. 37, that destroys bacteria so quickly that the time in which the reaction occurs can not be accurately measured, has been developed by Dr. Veader Leonard, assisted by Dr. William A. Feirer, of the Johns Hopkins School of Hygiene and Public Health.

The new germicide has the selective capacity of killing even the most resistant bacteria in fifteen seconds without injuring the most delicate tissues. The active agent responsible for this extraordinary germicidal power is hexylresorcinol, a synthetic chemical harmless to man but possessing over 70 times the germ-killing power of pure carbolic acid.

Hexylresorcinol was first developed in the Hopkins laboratories about three years ago. Since that time it has come into general use by the medical profession both here and abroad as an internal antiseptic. Dr. Leonard has continued his search, however, to find a way of "harnessing" his new compound so that it could be put to use as a general antiseptic.

After many experiments a solvent consisting of glycerine diluted with water was found that seems to answer all practical purposes. Dr. Leonard's research has thrown a great deal of light on the explanation of the great speed and efficiency of the hexylresorcinol's germicidal action.

"All fluids," he explained, "are endowed with a physical property known as 'surface tension.' This cohesive force, which can be measured accurately in tiny units known as dynes, is the force which makes a fluid like pure water draw itself up into small separate drops on surfaces such as a window pane, instead of flowing out over the surface of the glass in a thin film. Pure water has a very high surface tension—namely, 77 dynes, and for this reason will not penetrate into tiny spaces into which fluids of low surface tension will readily flow. Now hexylresorcinol is so incorporated in solution S. T. 37 that the lowest possible surface tension is maintained—it amounts to only 37 dynes—a fact from which the name S. T. 37 is derived. Being largely freed of this 'self-contracting' force, the solution is very penetrating. This allows the solution to come into contact with germs which may be lurking in the depths of tiny microscopic crevices—and which would otherwise escape destruction.

"Contact with the bacteria having been made, by means of this penetrating property, the same factor, low surface tension, now operates in two ways to speed up the destruction of the germ. In the first place, chemicals like hexylresorcinol, which lower the surface tension of their solutions very powerfully are known to concentrate themselves very rapidly on the surface of any tiny noncrystalline particles with which the solution comes in contact. This phenomenon is known to the physicists as mechanical adsorption and hexylresorcinol shows it in high degree. Now it so happens that germs are noncrystalline particles and when brought in contact with S. T. 37 the hexylresorcinol immediately becomes concentrated on the surface of these germs. The agent which destroys them actually seeks them out and 'pounces' on them, so to speak."

EARTHQUAKE WARNINGS

EARTHQUAKES of the future may be heralded by the ringing of an earthquake alarm bell a few hours before the shock. In this way there would be time for an exodus from tall buildings and other places where the greatest loss of life is likely to occur.

That such an earthquake warning is not at all impossible is the statement made by John W. Evans, British seismologist, in a letter to *Nature*. Investigations made by Professor Akitune Imamura, the leading Japanese earthquake expert, and presented by him at the recent Geodetic and Geophysical Union meeting in Prague, support his ideas.

The effect that Mr. Evans proposes to utilize is that of a tilting of the earth's surface which seems to happen usually a little while before a quake. In five Japanese earthquakes between 1793 and 1927, including the great quake in 1922, there was a lifting of the ground of a yard or two which preceded the quake by from half an hour to five hours.

By means of an instrument developed by another Japanese scientist, Ishimoto, a very slight tilting of the earth can be measured. So sensitive is this climograph, as the instrument is called, that it will detect a tilting of the earth so slight as to move a pole a mile high only a fiftieth of an inch at its top. With an earthquake that occurred in Japan last spring, said Professor Imamura, as quoted by Mr. Evans, this instrument showed a characteristic tilting which appeared from a few weeks to the day before the quake. About two and a half hours before the shock there was a rising of the ground of about a meter.

Mr. Evans suggests a chain of such stations for warning. "It would seem desirable," he says, "in regions subject to serious earthquakes, a number of local stations should each be equipped with a pair of simple horizontal pendulums, so adjusted that if any unusual tilt occurs a bell should ring automatically in the office of a central observer and the locality indicated there by a signal. He would then judge from the number of stations affected and the record of his own seismometer, whether the indications were sufficient to warrant him in giving the alarm.

PROPOSED RUSSIAN GEOLOGICAL SURVEY

THE Soviet republics of Russia are at last making practical attempts to utilize the vast mineral resources of the country. Professor D. J. Mushketov, director of the Geological Institute of Leningrad, has just completed

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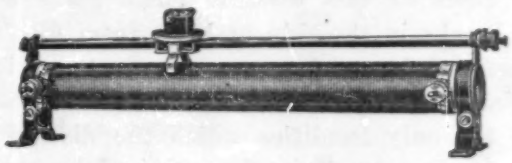

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a two months' visit to the United States, studying the administration of both the U. S. Geological Survey and the various state surveys, with the view of introducing a similar system in Russia.

The United States is the only country in which geology is an organized science, where geological problems approach those of Russia in magnitude or variety. For this reason he has been giving careful attention to the way in which geological departments in the different parts of the country are coordinated. Heretofore all the geological work in Russia has been done under the institute of which Professor Mushketov is director, but the country is so huge that such centralization is obviously inadequate.

In spite of the fact that the financial appropriation for geological investigations is 20 times what it was before the war, lack of funds is the chief obstacle in the way of the development of Russia's immense mineral resources. About 80 per cent. of all prospecting for mineral deposits is undertaken under the direction of the state geological institutions rather than by private companies.

Recent discoveries of potash made by the Geological Institute have rendered the Soviet republics independent of Germany in supplying their needs of this important chemical. Two strikes, one near Beresniki on the River Kame, and the other on the Soeikamsk, have uncovered a reserve of potash that is believed to be more than twice as great as that of Germany. The first mine will probably be operated by the government, but the others will probably be given to private concessions for export purposes.

New oil fields discovered in the Emba district on the north shore of the Caspian Sea, and others in Asia, promise to add materially to petroleum production.

Professor Mushketov has been especially interested in work done on geophysics in America particularly in the practical application of geophysical methods to such problems as prospecting for oil, water and ore deposits and the study of earthquakes and landslides.

TULAREMIA

Now that the season for rabbits has opened again, the American Public Health Association has issued a warning against tularemia, the rabbit disease that is sometimes transmitted to human beings.

Human cases of this disease, which gains access by means of breaks in the skin or bites from flies or ticks, have been found in nearly every state in the union. The New England States, New York, New Jersey and Delaware, are the only localities which the disease has not yet invaded. In man it is characterized by swelling of the lymph nodes, fever and slow convalescence with disablement for many weeks or even months.

Any workers in an occupation in which rabbits are skinned, dressed or cut up are especially liable to the infection. Ticks and flies found on horses, cows and sheep may also carry it. Even when frozen, diseased rabbits remain infective for three weeks, but are safe after four weeks. About ten per cent. of the rabbits on the market are infected, according to officials of the U. S. Public Health Service who are studying the disease, but those which have been thoroughly cooked are safe to eat. Workers who have occasion to handle the infected animals are advised to wear rubber gloves. The eradication of the ticks, flies and rabbits that carry the disease is practically impossible. Ticks remain infected for life and are able to transmit the infection through their eggs to the next generation. No preventive vaccine or curative serum has been perfected and no drug has any special value in treating the disease.

SERUM TREATMENT FOR MUSHROOM POISONING

What appears to be a successful serum for mushroom poisoning has been developed by Dr. Dujarric de la Riviere, professor at the Pasteur Institute in Paris, according to a report just made to the American Medical Association by its French correspondent.

The French doctor prepared his serum by inoculating a horse with increasing doses of four highly toxic mushrooms and then used it to treat laboratory animals, obtaining highly successful results.

When called to the assistance of a family in which three people had been poisoned at the same time, it happened that he was able to secure only two ampoules of the serum from the Pasteur Institute. These he administered to the two patients who appeared to be most seriously stricken, with the result that the two who received the serum injections recovered while the one who did not died.

When a report of his research was presented to the Congress of Hygiene, that body passed a resolution recommending that supplies of the new serum be kept in hospitals and so far as possible in the town halls of villages for the accommodation of physicians.

THE ORIGIN OF CLOTHES

Primitive man and his wife first took to wearing clothes in order to keep off stinging flies, sharp-billed mosquitoes, cooties, fleas and other lively pests. This simple answer to the puzzle problem: "How did we come to wear clothes, anyway?" is advanced by Dr. Knight Dunlap, professor of psychology at Johns Hopkins University.

"Crawling and flying pests are with primitive man abundantly and very intimately," Dr. Dunlap points out, in a paper to appear in the first issue of a new scientific publication, *The Journal of General Psychology*.

Skins or cloth might be wrapped tight around the body for protection against stings and bites, but this is confining and in warm climates impossible.

"Much more efficient protection is afforded by hanging strings, leaves, strips of hide, animals' tails and similar articles so that they will flap with the movements of the wearer," he says. "In other words, the best fly chasers are exactly the garments most characteristic of savages and primitive man. These afford protection without undue warmth or exclusion of ventilation.

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Ornaments such as nose rings, leg bands of fur, peculiar haircuts and designs tatooed in the skin were originally badges of identity, Dr. Dunlap concludes. Ornaments were, and still often are, worn to distinguish an individual as a member of a certain tribe. To the initiated, such regalia show whether the wearer is a married man or a bachelor, how many men he has killed in battle and how many cows he owns.

There have been but four theories of the origin of clothing. These are: First, the modesty theory (covering up the body); second, the immodesty theory (making the body mysterious and alluring); third, the adornment theory, and fourth, the utility or protection theory, with which Dr. Dunlap's explanation fits. "Clothing itself is not modest, or immodest," he says. "Any degree of clothing, including complete nudity, is perfectly modest as soon as we become thoroughly accustomed to it."

THE USES OF TAR AMONG INDIANS

A STRING of 33 dark, unattractive beads made from tar and found in the islands of the Santa Barbara Channel, is stated by experts to be an Indian relic of a kind hitherto never discovered. The beads are part of a valuable collection from southern California just acquired by the Museum of the American Indian, Heye Foundation.

The striking feature of the collection is the variety of uses which the California Indians found for tar. Crude lumps of bitumen cast up by the sea from subterranean tar pits made the only natural cement known to have been used by the Indians, according to Arthur Woodward, of the museum staff. Besides caulking their split plank canoes with the crude tar, they used it to fit together sections of their stone smoking pipes.

The early Spanish explorers described the men and women who came out to meet the Spanish ships, and mentioned the bone hair ornaments of the women which were encrusted with bits of iridescent shell inlaid on the bone with tar cement. The museum collection contains several of these hair ornaments, long flat fragments of deer bone. One, over nine inches long, has at one end a broad band of small shell beads fastened to the bone with the tar cement.

This form of ornament was found on many of the most prosaic household utensils, the cooking pots, cups, ladles and mortars. These are of stone or shell, as the islanders made no pottery.

"Like most of the native Americans, the islanders were musically inclined," Mr. Woodward says. "They made flageolets of the leg and wing bones of cranes and seagulls and other large birds, and here again bitumen came into use. The rims of the stop-holes were rings of pitch decorated with shell, while the reed in the mouthpiece of the flageolet was replaced by a small lump of bitumen. Even to-day, after years of disuse, some of the old musical instruments give forth the same shrill notes that were heard in the round thatched houses of the original musicians.

ITEMS

CLOTHES moths really do have a hard time chewing up woolen cloth and other fabrics of animal origin that have been impregnated with one of the various moth-proofing solutions now in wide use, according to Dr. E. A. Back, of the bureau of entomology of the U. S. Department of Agriculture. It is misleading, however, to offer an absolute guarantee of protection, and the common method of merely spraying the fabrics confers but little protection. The only way to do the job thoroughly is to wet the cloth through while it is still in the whole piece, and many manufacturers have installed special machinery for this purpose. One of the favorite and most widely-advertised moth-repellants consists of 97 per cent. of water with 3 per cent. of sodium aluminum silicon fluoride dissolved in it. Though this solution sells at a very high price under its copyrighted trade name, it really does work, if thoroughly applied. Another newly-marketed class of compounds is made of the cinchona alkaloids, chemically allied to quinine.

THE story of an Indian chief who has dictated to his secretaries a history of his tribe from the creation of the world as it is related in myths has just been brought back from Panama to Sweden by the explorer Erland Nordenskiold. Professor Nordenskiold is the son of the famous discoverer of the Northeast passage from the Atlantic to the Pacific Ocean. A copy of the Indian history is one of the rare trophies of his expedition. Professor Nordenskiold and his wife and other members of the party suffered severely from fevers and tropical diseases. While he visited the famous White Indians and the Choco tribe of Panama, his special interest was the Cuna tribe of the Atlantic coast. The Cunas are people of good intelligence and culture, who cling to their old traditions. The ruler, from whom the history of the world was obtained, employs two secretaries, one familiar with Spanish and one with English.

THE Chinese drug, ephedrine, that seemed for a time to rival the effects of adrenalin, the extract of the suprarenal glands famed for its so-called power to bring the dead to life, is not so potent as was at first believed, according to a report just made to the American Pharmaceutical Association. Ephedrine was isolated from a Chinese plant in 1887, but first received serious consideration in recent medicine through the researches of Dr. K. K. Chen at the University of Wisconsin. There seems to be little doubt that the drug possesses considerable merit in raising blood pressure, but recent investigations undertaken by Dr. L. W. Rowe, of the Parke, Davis & Company Laboratories, indicates that there is little evidence that it will supplant adrenalin as the first clinical reports led many physicians to believe. Dr. Rowe's work has shown that the new drug has a more lasting action when given hypodermically in large doses, but that its value when given by mouth has been somewhat exaggerated.

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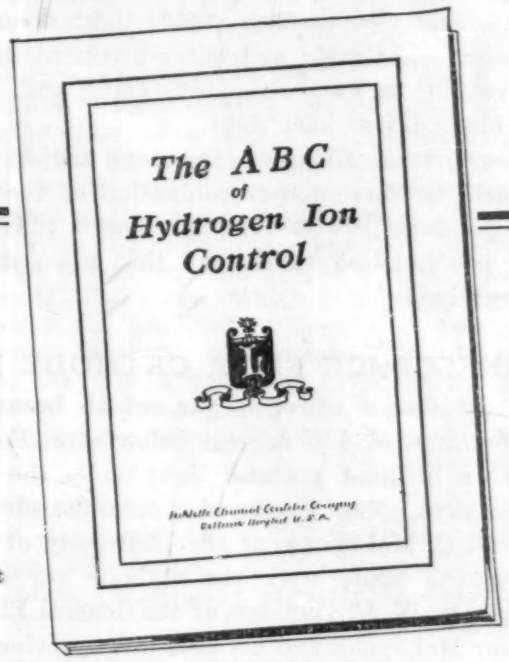

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SCIENCE NEWS

Science Service, Washington, D. C.

SYNTHETIC SUGAR

AN approximation of the process whereby living plants produce sugar from water and carbon dioxide, using the energy of light to make the combination, has been accomplished in the laboratory of Professor E. C. C. Baly, of Liverpool University. Using the most elaborate precautions against contamination of either his materials or the glass vessels used in the experiments, the British scientist and his associates have repeatedly produced substances that pass all the chemical tests for sugars.

The first tests were made with the invisible ultra-violet light as the source of energy. In these experiments, finely powdered iron and aluminum compounds were introduced into the water. These took no part in the reaction, but acted as catalysts, or chemical go-betweens, furnishing a large spread of surface on which the chemical action could take place.

But in nature the formation of food substances by plants is carried on by the power of visible rather than invisible light. The experimenters, therefore, sought a closer artificial approach to natural conditions. Since leaves have colored substances in them, colored catalysts were sought for the sugar-formation going on in the glass tubes. For this purpose carbonates of cobalt and nickel, both of which are colored salts, were found useful. With these in the tubes exposed to visible light from electric lamps, the carbon dioxide and water produced the sugars quite as readily as they came into being with colorless catalysts under ultra-violet light.

To the objection advanced by some critics that the sugars would be formed by combination of the gas and water in the dark, Professor Baly answers that he tried this over two hundred times, and that the results were always negative.

LUMINESCENCE FROM CATHODE RAYS

"ICE" of frozen nitrogen gas, which becomes solid at a temperature of 166 degrees below zero, Fahrenheit, glows with a brilliant greenish light under the influence of cathode rays. This is one of the results obtained by Professor J. C. McLennan, of the University of Toronto, in experiments made with the cathode ray developed recently by Dr. W. D. Coolidge, of the General Electric Co.

Professor McLennan and his associates previously made experiments with solidified nitrogen in a vacuum-tube, in an effort to determine what caused a strange green light in the aurora borealis. When the auroral light is passed through the prisms of a spectroscope, a green line appears. For a long time, the origin of this line was uncertain, but a few years ago a French scientist, Professor Vegard, claimed that it resulted from solid nitrogen when bombarded with cathode rays from the sun. Professor McLennan, however, announced at the Toronto meeting of the British Association for the Advancement of Science in 1924, that he had found the luminescence of solid nitrogen of different color from that of the green aurora line.

In the new experiments made with the Coolidge cathode ray tube, the experimenters find that there is not only the green luminescence while the solid nitrogen is bombarded by cathode rays, but that following the turning off of the tube, there is a greenish red phosphorescence that continues for a time. This, they believe, is due to the solid nitrogen changing from one molecular form to another, the second form being the one that continues to glow. The red glow, however, is not of the same wave-length as one that Professor Vegard claimed to have discovered.

OPTICAL GLASS

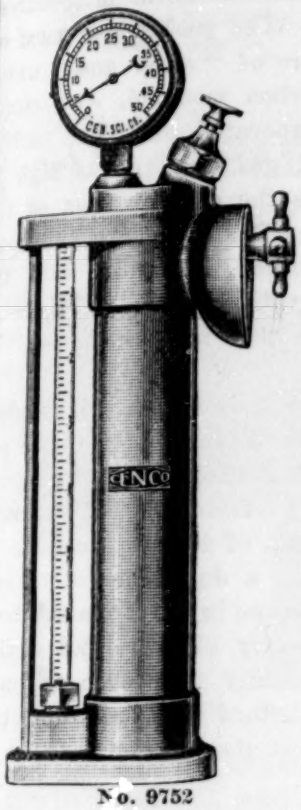
SOMETIME, about next February, scientists at the Bureau of Standards will know whether or not they have the largest disc of optical glass ever cast in the United States.

During the war, when European sources were closed, the bureau began to make optical glass. Last May these experiments reached a climax with the casting of a disc of glass 70 inches in diameter and 12½ inches thick. This is the largest disc that has ever been cast in the United States, and one of the largest in the world.

But such a disc is not finished when it is cast. Glass conducts heat very poorly. It is very hot when cast, for then it is in a molten condition. If simply exposed to the air as soon as it begins to harden, the outside would cool much more quickly than the interior. In doing so it would shrink, and the result would be that the disc would soon be merely a pile of small pieces of broken glass. Even if cooled more slowly, strains might be set up in the disc that would cause it to crack as soon as efforts were made to grind it into the dish shape of a reflecting telescope mirror.

Accordingly, it is necessary to extend the cooling over a period of many months. In making such a big disc, it is carefully enclosed in sand and fire clay so that it takes nearly a year to cool. This is called annealing. By February, 1928, the 70-inch disc at the bureau will have cooled sufficiently for the scientists to uncover it. Then they will know whether they have a disc or some pieces of broken glass.

Annealing is not always successful. The largest disc that has ever been cast, from which the 100-inch mirror of the big reflecting telescope at the Mt. Wilson Observatory was made, was completed only after a number of attempts. This was made at St. Gobain, France, where, before the war, the principal factory for large discs was located. Time after time discs were cast, only to find months later that they had cracked in annealing. Even the one finally used was not perfect, as it was cast in three layers, and when completed showed two layers



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of bubbles, like the filling in a layer cake. So it may be that the American optical glass workers will find in a few months that they have to try again.

Even if the disc comes out of the annealing safely, it is not known what will be done with it. The St. Gobain works were demolished, and many of their most skilled workers killed in the war, so that large discs are very hard to obtain. Several American observatories are in the market for big discs for reflecting telescopes, but just how the bureau's disc could be transferred to one of them is not certain. There are legal difficulties hampering the sale or gift of the glass, and so it might take an act of congress to dispose of it. But the bureau officials are not worrying about this bridge at present. What they are chiefly interested in is whether or not they have the disc.

CARBON MONOXID POISONING

WITH the return of cold weather the specter of carbon monoxid poisoning again haunts automobile drivers. Unless humanity has had a sudden access of caution, we may expect occasional news items about unlucky persons, warming up their motors in closed garages, being overcome and killed by this insidious, odorless, invisible gas.

Carbon monoxid is a product of imperfect combustion. When a fuel is burned under ideal conditions it is not produced. The only products of perfect combustion are carbon dioxid and water. But ideal combustion conditions are almost never realized, certainly not in even the best of automobile engines. The average of analyses of exhaust gases from 101 different makes of cars by the U. S. Bureau of Mines showed 7 per cent. of carbon monoxid.

In one experiment a dog was left in the driver's seat of a car in a tightly closed garage, with the engine running slowly. In 20 minutes the dog was found unconscious. The air in the garage was analyzed and found to contain 1½ per cent. of carbon monoxid. Had a man been in the dog's place the results would probably have been the same.

Because it has neither color nor odor, carbon monoxid frequently overcomes its victims with no warning whatever. The first symptom is a severe pain in the back of the head; but if the concentration of the gas is too high, the victim may lose consciousness before he can act on this warning. Small doses may have no other effect than to cause severe headache, but a heavy "gassing" is an exceedingly serious matter, and convalescents from carbon monoxid poisoning should be kept in bed even when they protest that they are "all right."

To avoid carbon monoxid poisoning, it needs no more than good ventilation in the garage, even at the expense of a cold motor, to make the place perfectly safe. Carbon monoxid is slightly lighter than air, and vanishes almost immediately through an open door or window.

Persons overcome by the gas should be given first aid by artificial respiration, and a doctor should be called immediately. In places where such accidents are at all likely to happen, the standard apparatus for administering oxygen, with the addition of 5 per cent. of carbon dioxid, should be kept in constant readiness.

Automobile engines are by no means the only sources of carbon monoxid poisoning. The fuel gas of most of our cities consists of a mixture of "water gas," which is made of hydrogen and carbon monoxid, with either natural gas or gas from evaporated oil. The carbon monoxid content of such fuel gas may run as high as 30 per cent.—over four times the concentration of the average automobile exhaust. Faulty gas connections, broken rubber tubing and other difficulties with the domestic gas supply have been blamed for ten times as many carbon monoxid casualties as are caused by automobiles.

Carbon monoxid would be a prime factor in modern warfare if it were not so easily dispelled in the open air. The high explosives with which shells are loaded generate great quantities of it; the gas from a TNT explosion contains as much as 60 per cent. of carbon monoxid. If a shell happens to explode in a dugout or other confined space, the soldiers who escape injury from the fragments and the concussion are very likely to fall victims to the gas. It is the more deadly since even the most modern types of gas mask afford far less protection against it than they do against the heavier varieties of military poison gas.

THE SUMMER OF 1927

THE past summer was cooler than usual in the eastern states, but hardly enough to justify the predictions of a summerless year, according to Professor Alfred J. Henry, of the U. S. Weather Bureau. Professor Henry has just announced the results of a study of abnormal summers. He finds that at New Haven, Conn., and at New Bedford, Mass., where the records extend back for a century, the past summer ranks No. 30 and 32 in coolness. At both these places the famous "year without a summer" of 1816 was the coolest, but at New Haven there have been 29 summers since that have been cooler than the past one, while at New Bedford there have been 31. In the western states, however, the summer was unusually warm. At Portland, Oregon, only the summer of 1926 was warmer than that of 1927, according to records which extend back for half a century. At San Francisco, 1927 ranks third as a warm summer, only 1888 and 1925 having been hotter.

In the middle west and east, only the records of Lynchburg, Virginia; Memphis, Tenn., and Cincinnati, Ohio, show 1927 to have had the coldest summer in fifty years. At New York, Philadelphia, Chicago, St. Louis and Indianapolis the last summer was the second coolest, while at Washington it was third coolest.

"In the last fifty-odd years," says Professor Henry, "four summers of exceptional coolness, 1903, 1907, 1915 and 1927, have occurred. Comparing these summers one finds that there is little to choose from as to which was the most conspicuous as to the depression of temperature. Considering the length of time the low temperature prevailed and the area affected and the minimum tempera-

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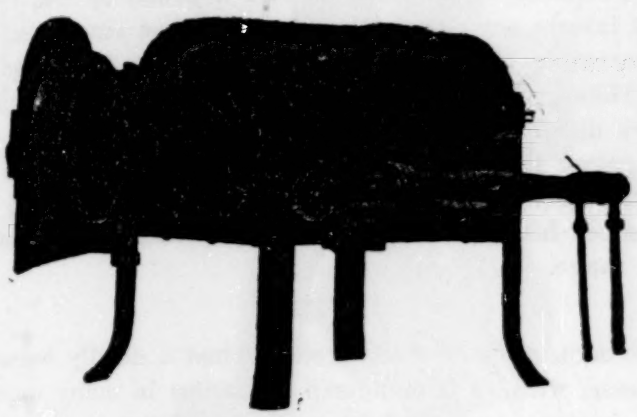

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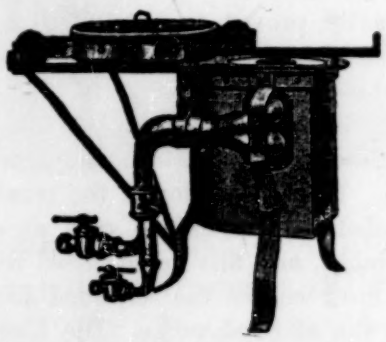

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ture recorded, 1915 should be given first place. Each month of that summer, including May and in a less degree September, was abnormally cold.

"The greatest depression of the temperature in the summer of 1907 was in June following an exceptionally cool April and May. The cool summer of that year may, therefore, be considered as a hold-over effect from the cold spring immediately preceding.

"The remaining three summers, 1903, 1915 and 1927, have several features in common, the most striking being the fact that each of them was preceded either in May or June by flood-producing rains in the lower Missouri Valley and adjacent territory. It may also be pointed out that the interval between these cool summers is exactly twelve years. If we go back another twelve years to 1891 we find that the mean July temperature of that year was the lowest on record up to that time in a large part of the country. The flood-producing rains were, however, absent to a great extent. Whether the heavy rains are the primary cause of the cool summers or whether both events are due to a common cause, is, of course, unknown."

In Alaska and Canada, Professor Henry points out, a period of warm weather began at the same time as the cool weather in the United States.

Professor Henry also suggests that the coolness of 1816 may have been exaggerated. During that year, he says, "there is not the slightest justification for assuming that the summer temperatures generally throughout the United States were unduly low."

THE MIGRATION OF STORKS

YOUNG storks find their way to the winter stamping grounds of their race whether they have a leader to show them the way or not, German scientists have found.

Studies with the birds that show that the migratory instinct manifests itself in storks regardless of outside influences have recently been reported to the American Ornithologists' Union by Dr. Theodor G. Ahrens, an American ornithologist living in Berlin.

Young storks with wings partially clamped down to prevent flying and fitted with identification bands, were kept in a marsh near Rossitten, East Prussia, by Professor A. Thienemann, of the Christian Albrechts University of Kiel. When the migrating season approached the birds were kept in cages until all the storks in Germany had flown south. Then they were carried back to the marsh and released. Reports of their band numbers, received from ornithologists in various parts of East Prussia who had picked them up, showed that they had followed more or less the customary route south without the guidance of leaders.

By December one of the birds was shot at Keratea, not far from Athens. The Greek police had some difficulty, Dr. Ahrens reported, in inducing the hunter to give up the bird's leg band because he wanted to keep it as a talisman. Some twenty other storks were seen in the same region at the same time. This report indicates that the leaderless storks while keeping to the south had veered to the west instead of taking the usual route to Africa by way of Asia Minor and Palestine. In spite of having been forcibly detained beyond the customary time for migration when the chance came, Dr. Ahrens pointed out, the birds knew what to do and did it.

Professor Thienemann repeated the experiment on a larger scale during the fall of this year, but returns have not yet been received to indicate the route by which the second lot of storks eventually found their way south. The large quantity of food that storks require, estimated by Professor Thienemann as over a pound of fish, frogs and insects per day, is thought to be one reason for the decrease in the numbers of these birds. Drainage of marshes and the growth of cities makes it more and more difficult for them to get food. The systematic use of poison to kill off insects in South Africa has also resulted in the death of many more storks who eat the poisoned insects for food while sojourning in their southern range.

ITEMS

INOCULATION of shade trees against a deadly bacterial disease, with an immune sap analogous in many ways to the immune sera used in medical and veterinary treatments, is being practiced by a German landscape architect, Walter Ilisch. Shortly after the war, a very destructive ailment of shade trees, especially troublesome to elms, began to be distressingly noticeable in German cities. It was traced to an original site in Holland, whence it has spread through the low countries, northern France and all of Germany. It was first ascribed to the polluted air of industrial cities, as well as a number of other causes, but finally proved to be due to a small round bacterium, known technically as a micrococcus, which invaded the water-conducting tubes in the sapwood and choked them. Herr Ilisch developed his immune sap treatment, which he injects into the trees by a very simple process. He bores holes in the trunk, drives into them long-bowled wooden pipes, such as old-time Germans like to smoke, and fills up the bowl with his preparation. The fluid enters the sapwood and distributes itself through the afflicted tubes. Die Umschau, a German scientific publication, vouches for the success of the treatment.

THE mummy of a prehistoric Indian, almost entire, has been unearthed in the Petrified Forest National Monument, in Colorado, and placed in the museum there. The find was made by William Cox Buehler, custodian of the reservation, who states that the slightly undershot jaw places the Indian in the class of "oldest inhabitants." Evidently the aborigine was a prominent member of his tribe, judging from the carefully prepared grave, which was lined with sandstone slabs and was in a good state of preservation when found. The skeleton had charcoal under and over it, even in its ribs and eyesockets. Its skull was in good shape, the teeth in especially fine condition. Other articles of archeological interest brought to light in uncovering the skeleton were two whole bowls, a stone hammer, two grinding bowls and some grinding stones. These also were placed in the museum.

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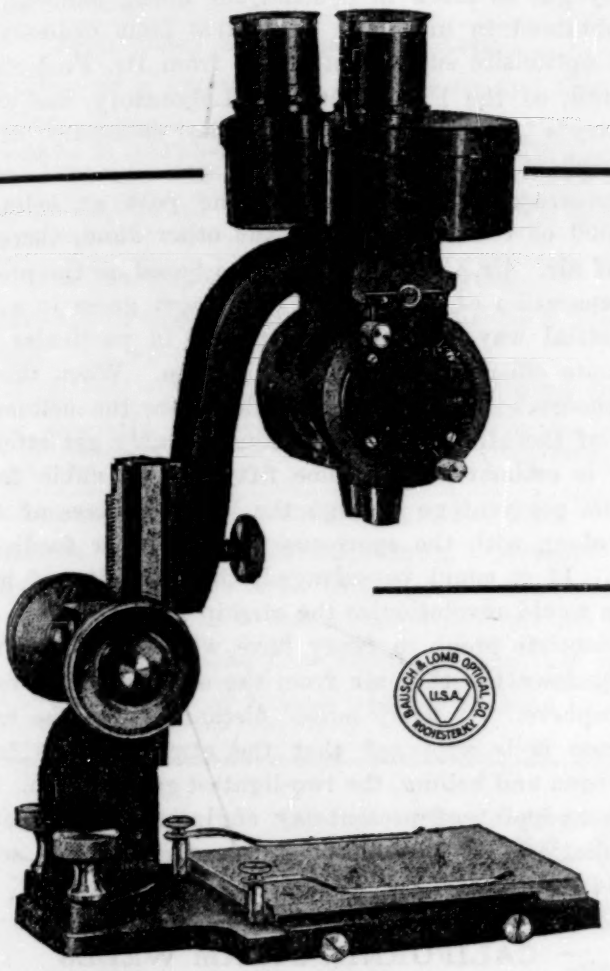

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SCIENCE NEWS

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DISCOVERIES OF THE HAMBURG OBSERVATORY

DISCOVERY by the same two astronomers of a nova, or "new" star, and a new comet, within three days, is a new astronomical record which was made last week at the Hamburg Observatory at Bergedorff, Germany. According to cables just received at the Harvard College Observatory, which acts as the American clearing house for announcements of astronomical discoveries, Dr. A. Schwassman and Dr. Wachmann, his associate, set this record.

The astronomers found a new comet in the constellation of Pisces, the Fishes, on November 15. This star group is in the southern sky now in the late evening, east of the so-called "Great Square of Pegasus." But as the comet was only of the fourteenth magnitude when found, it can only be seen with a large telescope. It was moving towards the southwest, its exact position, in the astronomical coordinates, being 1 hour, 32 minutes and 12 seconds right ascension, and 20 degrees and 53 minutes north declination.

The nova was found on November 18. Then it was of the tenth magnitude, also too faint to be seen except with powerful telescopic aid. Its position is 5 hours, 15 minutes and 12 seconds right ascension, and 16 degrees and 38 minutes north declination. This is in the constellation of Orion, the familiar star group, which is now seen low in the southeastern evening sky.

Upon receiving the report of the nova, Professor Harlow Shapley, director of the Harvard College Observatory, made an inspection of the photographs of the sky that are taken regularly at Harvard and found that since September the new star had been unknowingly photographed twenty times. Special photographs made immediately upon receipt of the news from Germany show the object to be a true nova. From the photographic record of the star's career, it was determined that on October 1 it reached its maximum brightness of near seventh magnitude, not quite visible to the naked eye. This is evidence that the new star is now on the wane.

A nova is not really a "new" star, but a previously faint one that suddenly becomes bright. This continues only temporarily, however, for it soon begins to return to its former obscurity. Just what causes the outburst, which is really an explosion, is not known. One theory that has been held is that it is due to two stars colliding, but now it is supposed that such collisions are much too rare to account for the frequency of such outbursts. The principal belief now is that the explosion is due to some sudden atomic change. During the summer another German astronomer, Dr. Max Wolf, of the Heidelberg University Observatory, found a nova, which was then found to have been photographed at the Harvard College Observatory several months previously, in June.

HELIUM FROM AIR

AIRSHIP makers take courage. Helium, the valuable safety gas so much in demand for filling balloons, may be obtained in unlimited quantities from ordinary air. This optimisitc suggestion comes from Dr. Frederick G. Cottrell, of the Fixed Nitrogen Laboratory, one of the country's foremost experts in the chemistry of the atmosphere.

Unfortunately, there is but one part of helium in 180,000 of common air. On the other hand, there is a lot of air. Dr. Cottrell's hopes are based on the prospect of separation of air into its component gases in a large industrial way, whereby the oxygen in particular is to be more efficiently used in combustion. When this sort of wholesale air analysis is undertaken, the helium content of the atmosphere will unquestionably get attention.

It is estimated that some fifty million cubic feet of helium per year go through the blast furnaces of America, along with the enormous volume of air feeding the fires. If it could be salvaged, this quantity of helium alone would revolutionize the airship industry.

Scientists prone to fancy have wished that one might pump down the thin air from the outside of the earth's atmosphere. At many miles' distance above the earth's surface it is supposed that the atmosphere is largely hydrogen and helium, the two lightest gases known. From the standpoint of present-day engineering, however, the installation of a stand-pipe to tap these lighter zephyrs would present serious difficulties.

CALIFORNIA STEAM WELLS

STEAM wells, where the earth is tapped for natural heat as it is elsewhere for natural gas or oil, promise to deliver power in paying quantities and at the same time to yield data of value in the study of the ancient riddle of geysers, hot springs and fumaroles.

The first development of this kind in America, at "The Geysers" in California, has been given a thorough scientific examination by Dr. E. T. Allen and Dr. Arthur L. Day, of the Carnegie Institution of Washington, and their report has just been made public.

The steam well region is in a little valley in the Coast Range, near San Francisco. There is abundant evidence that the region saw much volcanic activity in the past, and the steam rising through the earth, causing fumaroles and hot springs, is probably the product of deeply buried lava that has not yet cooled. The name "The Geysers," however, the Washington scientists state, is a misnomer, for there are no active geysers in the valley and no signs that there ever were any. Even the natural steam and hot water escapes are less marked than they are in many other similar regions.

Nevertheless, there seems to be abundant steam at high temperatures and pressures when the borings are sunk.

NEW SCIENTIFIC BOOKS

Columbia University Press, New York

THE SCIENTIFIC HABIT OF THOUGHT. Frederick Barry. pp. xii + 358. $3.50.

An informal discussion of the source and character of dependable knowledge. The purpose of the book is to point out the importance of acquiring the scientific habit of thought and the methods of doing so, as against the mere acquisition of scientific facts.

John Wiley and Sons, New York

THE MAKING OF A CHEMICAL. E. I. Lewis and George King. 288 pp. $4.00.

This volume is intended to give an insight into the practice and conditions that obtain in a chemical works, for students in the chemical laboratories of colleges and universities, as well as for those wishing to enter or having recently entered the chemical industry.

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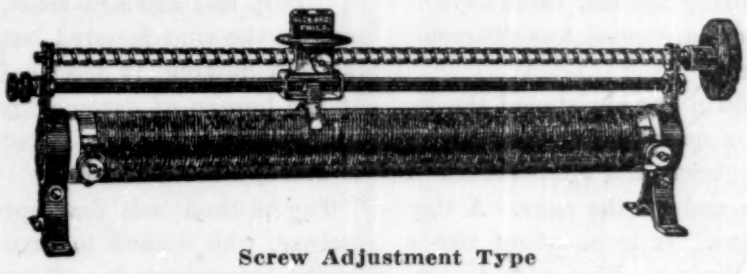

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Eight wells have been put down so far, to depths of between 200 and 650 feet. These develop steam pressures between 60 and 275 pounds per square inch. Quantitative measurements of the output of four of the wells indicate a power equivalent to 4,500 kilowatts, or over 1,000 kilowatts per well.

In spite of the borings, no diminution of steam flow at the natural fumaroles in the valley has been noted. Neither do the wells seem to diminish each other's activity, although two of them are within 50 feet of each other. In fact, all the wells have shown an increase in both the pressure and temperature of their steam for a certain period after they were first opened.

A similar enterprise on a larger scale has been conducted at Larderello, Italy, where the commercial production of power has already been realized. The California development has one advantage over the Italian wells, in that the Larderello steam contains corrosive acids, which necessitates more or less elaborate purifying processes before it can be used, whereas the California wells yield a steam whose acidity is so low that it can be used in its natural state.

THE NESTING OF BIRDS

AN elaborate electrical device on the order of a potentiometer has enabled S. Prentiss Baldwin, director of the Baldwin Bird Research Laboratory near Cleveland, Ohio, to tell exactly how much time the mother wren spends on the nest incubating her eggs and how much time she takes off.

Thirteen minutes appear to be about the average length of the time she can stick on the job, but she seldom stays off longer than six minutes. Almost always she broods her eggs all night during the nesting period, though Mr. Baldwin has a record of one flighty female wren that went out for the evening at 8:50 P. M. and did not return until 1:04 A. M. During the last three days of the incubation period the absences are much less frequent, but of about the same duration.

The wrenograph, as Mr. Baldwin has christened the instrument, is a thermoelectrical apparatus connected with the electric light circuit that registers the temperature of the nest each time bird goes on and off the eggs. A tiny wire is stretched across the eggs. It looks about like a strand of straw from the nest lining. This wire is connected with a self-recording instrument in the laboratory that registers on a chart the temperature accurate to within one degree Fahrenheit. It is probably the first time that such apparatus has been used to obtain accurate information about the life history of birds.

Two other instruments based on the same principle, but not self-recording, give more accurate nest and egg temperatures as well as the temperature of the atmosphere near the nest. This enables the bird research workers to note the temperature adjustments in the nest to the warm and cold "spells" outside during the incubation period.

Mr. Baldwin, assisted by two young ornithologists, has been engaged in making an intensive study of house wrens at his laboratory at Gates Mills. Hundreds of pairs of these vociferous songsters nest in the vicinity in specially constructed and numbered bird-houses. By banding the young wrens shortly after they are hatched, a daily record is kept of the life of the wren inhabitants of the bird boxes over a range of a hundred acres. From the data he has compiled in this new field of research, Mr. Baldwin expects to write a monograph on the life history of the house wren.

METHODS FOR CONTROLLING INSECT PESTS

THE warfare now being waged against forest insects in many parts of the world by means of airplanes that swoop over the trees scattering clouds of poison dust in their wake received a dramatic justification in Czecho-Slovakia recently, according to Dr. L. O. Howard, of the U. S. Department of Agriculture.

During his recent European tour Dr. Howard was shown a tract of spruce woods in Czecho-Slovakia. This forest was divided into three parts, one of which was owned by the government, one by a wealthy nobleman and the third by a neighboring city. When it was proposed to dust the forest from an airplane, to check the ravages of the destructive nun moth, the government and the owner of the private estate agreed to assume their share of the cost, but the municipality refused to spend the money. The aviator, therefore, dusted the portions of the forest for which protection had been provided, and left the municipal forest untreated.

During the past season the results of the divergent policies became apparent. The government and private parts of the forest were in thriving and healthy condition, whereas the municipal forest fell a victim to the false economy of the city fathers, and is now practically ruined by the moths. It will have to be cut down and sold for paper-pulp at a fraction of its value.

A new style of chemical warfare against insect pests of forest and orchard trees, which may partly or wholly replace the time-honored but expensive methods of spraying and dusting, is described by Dr. L. O. Howard, chief of the bureau of entomology of the U. S. Department of Agriculture. He saw it being tried out during his stay in Europe this summer.

The method was developed by chemical warfare technicians, who wished to turn their military talents to use in the arts of peace. The materials used resemble somewhat the "smoke candles" used to generate a smoke screen in war time, except that the fumes given off by these peace-time chemical smudges contain arsenic, the favorite poison for use against chewing insects.

In some places the arsenic smokes are set on the ground at intervals, and in others they are carried through the grove or orchard on long poles by a rank of men. In either case they fill the air with a white fog, which takes about an hour to settle. At the end of that time an examination of the leaves shows that they are covered with a thin deposit of arsenical residue. Results are not all in from the first experiments, but if the new method is effective against the insects its cheapness and quickness of operation will be strong arguments in favor of its general adoption.

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THE DETERMINATION OF SEX IN INSECTS

A NEW angle in the already complicated puzzle of the cause of sex in animals has been uncovered by the researches of three workers in the U. S. Department of Agriculture, Dr. N. A. Cobb, Dr. G. Steiner and Dr. J. R. Christie. Stated roughly, they have found that crowded quarters, possibly complicated by short rations, tend to produce males, while more room and better living conditions generally tend to produce females, in certain parasitic hairworms that infest the bodies of insects.

Their discovery was the result of an effort to play the old game of the fighting entomologist, turning one small creature against another in man's unending warfare on the devouring hosts that threaten his crops. In the present instance they were trying to find how many eggs of the hairworms a grasshopper would have to eat on his natural diet of leaves, to become so heavily infested that he would die without descendants. An average of less than fifty was required. A few less and the hopper lived, but could produce no offspring.

This in itself was an interesting discovery in the physiology of sex, but a more startling fact was learned about the sex reactions of the worms themselves.

To begin with it was found that unmated female hairworms laid eggs which hatched in perfectly normal fashion, but that all the young from these fatherless eggs were females.

But when these unfertilized eggs were fed to grasshoppers in excessive numbers, the worms that hatched from them were all males. When only a few eggs were administered to the victim hoppers, they hatched out females. Intermediate numbers turned out mixed batches of males and females, the proportion of males bearing a fairly constant relation to the number of eggs swallowed by the luckless grasshoppers.

Results similar to those observed on grasshoppers were obtained both in the laboratory and in the field with ants, midgets, tea-bugs and other insects and their special genera of hairworms.

Dr. Cobb and his associates suggest that inasmuch as grasshoppers are very abundant and their hairworm parasites even more so, good opportunities for further research into the causes and possible control of sex are offered by this material.

BARRO COLORADO ISLAND

DR. FRANK CHAPMAN, of the American Museum of Natural History, said recently in reporting the activities of the station for the study of wild life at Barro Colorado Island in Gatun Lake, that it is the only place within the jurisdiction of the United States where the continental flora and fauna characteristic of the American continents in the tropics can be studied within the jurisdiction of the United States. Since all the rest of our tropical possessions are islands, having their own characteristic types of animals, Barro Colorado presents special advantages to scientists interested in the tropical wild life of the continent.

The island, which is really a headland of the mainland cut off by the backing up of waters reserved for the locks of the canal, is teeming with birds and animals of the most diverse forms. "On a single morning," said Dr. Chapman, "I observed passing before my door any number of coati (a small animal about the size of a raccoon), a little flock of peccaries, a procession of howling monkeys and the Duke and Duchess of York."

As a result of his observations on the island, Dr. Chapman has reached the conclusion that the turkey buzzard's unerring instinct for locating carrion is due to a phenomenally keen sense of smell as much as to the sense of sight.

Careful observations of a colony in the treetops revealed the fact that the female Baltimore orioles build the long pendulous nests quite unassisted and vie with each other for the favors of the polygamous males. Only seven of the latter were counted in a colony of 42 females.

A tiny humming bird, nesting in the same neighborhood with the orioles, was discovered to be dominating the whole tree.

ITEMS

CLIMBING Africa's highest mountain was all in the day's work to two explorers of the Bureau of Plant Industry, U. S. Department of Agriculture, according to reports received outlining the achievements of L. W. Kephart, associate agronomist, and R. L. Piemeisel, associate physiologist of the bureau. Although equipped only for collecting plants, seeds and soil samples, the explorers last month conquered Mount Kilimanjaro's more than 19,000 feet in the time usually required by expert mountain climbers fully equipped for the purpose. The mountain is a huge volcanic cone. It has two peaks, called Mawenzi and Kibo, Mawenzi being the older of the two and Kibo the higher by over 2,000 feet. Ice-capped Kibo is shaped like a huge dome, is covered with glaciers and has a crater in the center of its top. In ascending Kibo, the explorers were in considerable danger, particularly during the last three quarters of a mile of the climb which was over treacherously loose sand and gravel. After reaching Gilman Point, which is usually considered the top of Kibo, but which is about 100 feet below the actual summit of the ice-cap, known as Kaiser Wilhelm Spitze, the men returned to Moshi, Africa, with a large number of plant specimens and photographs.

A NEW royal burial chamber, from the Bronze Age, has been found by Swedish archeologists at Dendra, in Greece, where last year sensational discoveries were made. A report by Professor Axel W. Persson says that the new excavations have revealed a house carved out of the rock, over 30 feet long, 15 feet wide, with a peaked roof. Articles so far recovered from the royal tomb include a lamp 18 inches high, and two smaller lamps of a kind of stone found in Crete, showing early trade relations between Greece and that island. Three large alabaster vases and several carved placques evidently used on a sacrificial altar were also removed from the chamber. A depression in the floor was found filled with bronze objects, including seven goblets, four lamps, a drinking horn, two razors, a sword with ivory hilt, and four mirrors.

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SCIENCE NEWS

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THE COMPOSITION OF THE STARS

A NEW answer to the old question, "Twinkle, twinkle, little star; how I wonder what you are!" is supplied by Professor J. H. Jeans, the British astronomer, who suggests that stars may be largely liquid. Previously astronomers almost universally have supposed that with the high temperatures involved, stars could be nothing but great bubbles of gas.

In a communication to the Royal Astronomical Society, of which last year he was president, Professor Jeans points out that the fact that so many stars in the sky are double favors his theory. These double, or binary, stars, consist of two separate bodies that revolve around their center of gravity. It is supposed that many were originally single bodies, but that they divided in some way, thus producing two. Such a process of "fission" is similar to the way in which very simple animals, like the amoeba, reproduce. They merely divide into two, and then there are two amoebae where before there was only one.

If, however, the star was made of gas, such fission would not take place, but a certain part of the gas would be expelled from the star's equator. But if the star had a liquid core, such division could take place. In any condition, according to Professor Jeans, the outer part of the star would still be gaseous.

On the basis of this theory Professor Jeans has worked out a modification of the accepted ideas of the evolution of the stars. He thinks that at different temperatures the atoms of which the star consists are of different sizes. This is because they are "ionized," which means that the outermost of the rings of electrons of which they are partly made, are broken off. The star gradually contracts and gets hotter, thus stripping off more of the rings of electrons. Occasionally there may be short periods where the star is gaseous, but then the center becomes liquid again and is again stable for a time.

The final state of the star is what is called a white dwarf. In such a star the rings of electrons have been removed, and consequently there can be no further contraction. "This state of complete ionization," says Professor Jeans, "provides a sort of 'cold storage'—if the metaphor is not too inappropriate to temperature of about a thousand million degrees—in which stellar atoms, no matter how great their normal generating capacity, are preserved from decay."

"Possibly," he continues, "the nuclei of the spiral nebulae constitute vast storehouses of such matter which only begins to undergo annihilation and to emit radiation when first formed into stars." The life of a particular star, known as Plaskett's star, one of the white dwarfs, he says, "can hardly have been more than some 100,000,000,000 years, but the atoms of which it is composed may have previously lived an infinitely longer life, completely ionized at the center of a nebula, and therefore stagnant and immune from annihilation. As a corollary, it would be difficult to deny that all the matter of the universe may have been created at the same instant."

Though the normal evolution of a star seems to be from one stage to another, Professor Jeans thinks it possible that a star may slip and fall down several steps at once. "It is slightly disconcerting," he says, "to notice that our sun is perilously near to the dangerous left-hand edge of the main sequence, so that its collapse into a feebly-luminous white dwarf may start at any instant."

TROPICAL OCEAN STORMS AND AMERICAN COLD WAVES

"NORTHERS," severe storms of the Gulf of Mexico and the Caribbean Sea, which are most numerous in the winter months, start as cold waves in the Dakotas, and wreak their havoc in the Middle West before going to sea. This is the statement of Willis Edwin Hurd, of the U. S. Weather Bureau, who has been studying these storms and their origin. "From the very nature of the norther," says Mr. Hurd, "one recognizes the fact that it is dependent for its strength and maintenance upon the magnitude, movement and relative positions of the high and low pressure areas crossing the United States and the waters to the southward."

Mr. Hurd describes the formation of the norther as follows: "A blizzard sweeps down from the northwest, the high wind blowing along the eastern wall of the anticyclone. The air is biting with intense cold and blinding with fine snow particles so thick that they obliterate all objects more than a few feet from the eye. Meanwhile, as the storm descends from the Dakotas, the air over the Texas plains is warm and humid, with a springlike balminess characteristic of many of the winter low-pressure areas of this region. Suddenly dark clouds, advancing slowly or with tumultuous rapidity from the northward, mark the southern squall line of the storm wave. Here comes the blizzard; but now, if we wish, we may call it a 'Texas norther.' The first blast of the squall is cold. If rain has been falling, the precipitation may quickly change to sleet or snow. This, with the sharp fall in temperature, is highly disagreeable to all living beings, even deadly if accompanied by too long exposure, while it is disastrous to tender vegetation. If there has been no precipitation preceding the burst, and none should happen to follow it, the norther may be classed as dry instead of wet.

"The anticyclone continues to advance southward, meanwhile spreading toward the east. It reaches the coast and enters upon the waters of the Gulf of Mexico. There great velocities may be developed, and squalls of even greater intensity may occur along particularly exposed portions of the coast. Meanwhile the line of frost also advances into the southland. A freeze threatens the

The MONIST

January, 1928

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orange groves. The inhabitants of eastern Mexico, even of Honduras, the Florida Keys, and of Cuba, perhaps shiver under the influence of the unwonted chill. Small streams of the norther flow over the Mexican passes of the Cordilleras into the Pacific, but the great main current passes on to the southward and eastward, into the Caribbean and toward the open Atlantic, not only cooling and disturbing the eastern littoral of the upper Central American States and adjacent waters to the West Indies, but finally perhaps venting the last feeble puffs of its energy upon the harbors of Panama and even the more distant coasts of Colombia. Thus, for this is not merely an ideal picture, has the fierce cold wave and blizzard of the Dakotas penetrated as a norther into the Equatorial Zone.''

Even the Canal Zone is not exempt from northers, for some of the storms sweep down well into the tropical regions. The movements of the storms over the United States furnish warnings which are sent out by radio.

RUBBER PLANTS IN MEXICO

BACKED by Thomas Edison, a rubber exploration of the semi-arid lands in southwestern Texas and the adjacent territory in Mexico has been carried on during the past few weeks. Dr. J. N. Rose, of the U. S. National Herbarium, has brought back to Washington a number of specimens of plants suspected of rubber-yielding possibilities.

''The plants I paid most attention to were those belonging to the milkweed and euphorbia or spurge families,'' said Dr. Rose. ''The milkweeds have long been known to have rubber in their milky juice, but so far it has not been found in paying quantities. The euphorbias include such familiar plants as the Christmas thorn and the poinsettia, and are somewhat more distantly related to the Hevea, or Para rubber tree, now the chief source of our rubber.

''The most promising species I found was one member of the euphorbia group. A rough analysis of its latex, made by a local chemist, indicated a rubber content of nine per cent. Whether this will be confirmed by more careful examinations in specially equipped laboratories I have, of course, no way of knowing just yet.

''Of course, sensational promises of great rubber plantations in Texas would be nothing but pipe dreams. Mr. Edison has made it quite plain, I believe, that what he has in mind in his present program is the development of a potential emergency supply, which could be drawn upon if a war or other calamity should cut us off from the cheaper rubber of the tropics.''

The Mexican part of Dr. Rose's expedition took him south along the Gulf Coast about a hundred miles beyond the border. This was during the time of the recent abortive revolution; but Dr. Rose reports that this part of Mexico was not affected by the uprising, and that in any case most of the region was uninhabited.

HYPERPARASITES

GOVERNMENT efforts to fight the depredations of the gypsy and brown-tailed moths have been handicapped this year by the fact that one of the parasitic insects used to prey on the moths and reduce their numbers has itself been destroyed to an alarming extent by parasites.

One of the most promising moth parasites, known as Apanteles, which feeds on the larvae, produces two generations each year and multiplies at such a high rate that it was hoped it would prove to be a great check on the moth pest. However, government experts have found that this species is itself a prey of parasites whose work, combined with other unfavorable factors, is so deadly that frequently not more than one per cent. of the second generation is likely to produce adults.

Parasites upon parasites are called hyperparasites and the studies made of the afflicted species show that some 35 kinds of hyperparasites prey upon it, 14 being responsible for about 90 per cent. of the total parasitism. Curious to note, these hyperparasites are in turn preyed upon by parasites, which scientists call tertiary parasites.

Apanteles is a somewhat discriminating feeder and preys on only the gypsy moth and a few other varieties, but the hyperparasites are not so particular, regularly attacking many parasitic insects. A short crop of Apanteles, therefore, does not mean that the number of its enemies will be reduced correspondingly the following year. However, when the Apanteles is scarce there usually is a pronounced reduction in the numbers of hyperparasites. A happier side of the situation is that the Apanteles in its native home is attacked as seriously by hyperparasites as is the case in America, but it continues to survive and at times is one of the chief enemies of the gypsy moth. There is a close relationship between hosts and parasites, hyper and tertiary parasites at all times.

ITEMS

To test the claims that artificial silk cloth allowed large amounts of the health-giving, short wave-lengths of sunlight to pass through, various fabrics were submitted to test at the National Bureau of Standards. Cotton was found to be nearly as transparent to the ultra-violet light as viscose and cellulose acetate, and real silk had about the same transparency as cotton. The viscose artificial silk was more transparent than that made from cellulose acetate, but the maximum transparency measured was only 27 per cent. Dyes or the yellowing due to age was found to reduce the transmission to only about 5 to 10 per cent. and in most fabrics the threads occupy 95 to 99 per cent. of the total space. The experts conclude that the composition of the fabric is of less importance than the coarseness of weave.

THE chipped stones from the seacoast of Sligo, Ireland, which were recently described by the British archeologist J. P. T. Burchell as implements made by early Stone Age men, have become the subject of scientific controversy. A committee of Dublin investigators, R. A. S. Macalister, J. Kaye Charlesworth, R. Lloyd Praeger and A. W. Stelfox, have reported to *Nature* that they have investigated the caves on the Irish coast and find that they are apparently of a much later date, geologically, than the Old Stone Age. They declare further that the chipped stones in question are of limestone, a most unsuitable material for implements, and that they can not find any evidence that the chipping is the result of anything but accidental fracture.

The MONIST

January, 1928

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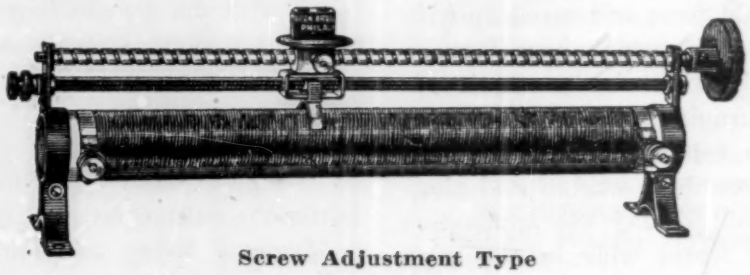

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PARESIS AND MALARIA

FORTY years of devotion to a theory, literally a lifetime of work, stand back of the achievement for which Professor Julius Wagner-Jauregg, of the University of Vienna, has just received the 1927 Nobel prize in medicine.

It was as far back as 1887 that Professor Wagner-Jauregg published his first paper, explaining his fundamental idea that febrile disease had an ameliorating effect on paralysis. Even then the idea was not new, for observers as long ago as the time of Hippocrates and Galen had noted that intermittent fevers produced favorable effects on the paralytic insane. But the Viennese psychiatrist took the clinical observations of his predecessors and contemporaries, added his own and built up a theory that he believed in. For years he struggled to collect data to prove his theory. He tried to induce curative effects on hopeless paralytics by inoculations with typhoid, tuberculin erysipelas and intermittent fevers.

Different workers with mental disease observed that in the tropics where malaria was frequent and syphilis extraordinarily common among the native population, paresis, the deadly form of paralysis that often occurs in the last stages of syphilis, was unknown. This state of affairs was specially well demonstrated in both Java and in China. Furthermore, malaria presented the special advantages, for clinical use, of being recurrent—it could come back at the spirochaetes in the body enfeebled by the first malarial attack and subject them to uncomfortably high temperatures again and again. It could be administered in a relatively mild form and cured up with quinine. Accordingly in 1917, Professor Wagner-Jauregg made his first trial of malaria with nine paralytic patients. The results were encouraging. He continued the treatment. Other institutions followed, for it must be remembered that up to this time there was no real alternative for paralysis but death. To-day the application of the method is practically world wide in the more advanced institutions where the paralytic insane are housed.

Though his grave and rather grim features have earned him the typical student-applied nickname of the "wooden statue," Professor Wagner-Jauregg's lectures are enormously popular. An occasional twinkle belies his dour expression, while one of his former students declares that he is not above an unprofessorial joke. Those who have worked with him in Vienna describe him as a marvelous physician and skilled clinician with an infinite capacity for painstaking research.

Further developments of the malarial treatment in which he is particularly interested at the present time are the preventive use of malaria in syphilitic patients before they develop paresis and a project for the finding of some method whereby malarial blood can be shipped from laboratory to laboratory. This feature is of special importance on account of the hit and miss chances of institutions finding a suitable malarial case just when they need it for inoculation of their paralytics. With all the health propaganda against the mosquito, good useful malaria cases of the right type are getting hard to find in the more enlightened countries.

TUBERCULOSIS INFECTION

IF a man or woman, who is united to a matrimonial partner with open tuberculosis, is below par physically, his or her chances of acquiring the same dreaded infection are about one in six.

This is the conclusion Dr. Arnold Minnig, of Denver, has drawn from analysis of data from over 5,000 tuberculosis cases he has observed at the Denver Municipal Tuberculosis Dispensary. Out of a total of 5,067, 1,888 cases were married or widowed. Of these, 319, or 16.8 per cent., Dr. Minnig has reported to the American Medical Association, were cases in which both consorts had active tuberculosis or one or the other died of the disease.

These figures in the opinion of the Denver physician refute the theory held by some medical men that adult infection with tuberculosis is not possible. He points out that only eleven cases of the 319 were natives of Colorado, which has a notoriously healthy climate. Since five of these died, the unpleasant possibility is suggested that a healthy climate may have the adverse effect of preserving its inhabitants from the immunizing contact with tubercle bacilli that is found in large cities, so that when such unimmunized individuals come in touch with the disease they succumb with startling ease.

Dr. Minnig's figures were drawn from dispensary cases, which necessarily represent the lowest stratum in life. Consequently, he states that "this investigation gives us a most important lesson; the lower the standard of living, or the more unhygienic the surroundings, the better the culture medium for the tubercle bacillus."

Hygienic living and intelligent prophylaxis are the weapons to be used to prevent tuberculosis spreading in families, just as they are everywhere else that the great white plague is found.

FOSSIL LEAVES IN YELLOWSTONE PARK

NEW evidence that magnolias, sycamores and chestnut trees once flourished in the region now known as Yellowstone National Park was uncovered by the blasting away of a ledge to widen a section of the park's loop road between Mammoth Hot Springs and Camp Roosevelt. Tons of rock bearing the fossil imprint of leaves and twigs, principally magnolia and chestnut, were brought to light. According to Professor H. L. Mason, of the University of California, the rock bearing the fossils represents the material accumulated in a forest about four million years ago, during a volcanic eruption which

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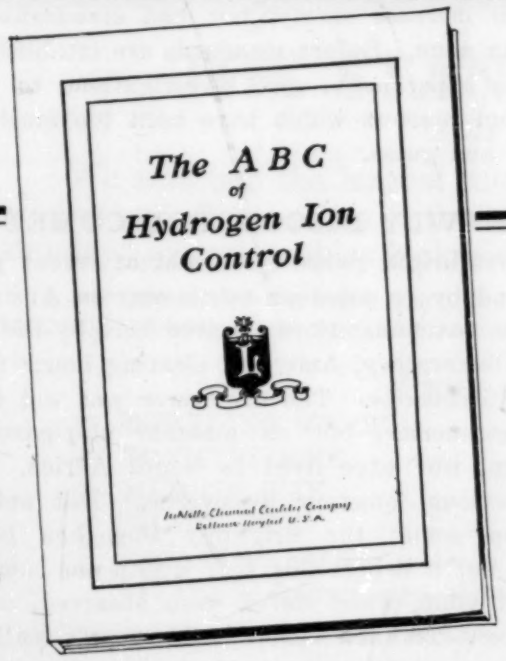

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destroyed the trees and buried the leaves upon the ground. Impressions of the leaves then became a part of the solid rock. Judging from the abundance of chestnut leaves, the chestnut apparently was one of the most common trees in this prehistoric forest.

The leaves in the rock show minutely every stem and vein, and each needle-like point in the serrate edges of the chestnut leaves is wonderfully preserved. Even the work of insects is as clear in the hard stone as it would have been in the green leaf itself.

To-day the magnolia thrives in the southern portion of the United States, and the chestnut is not found west of the Mississippi. It seems probable that these trees and the redwoods, which also are known to have lived in the Yellowstone region in past ages, were driven out by the building up of the mountains which to-day are a suitable habitat for the hardy pines and aspens.

A NATIONAL PRONGHORN SANCTUARY

A GREAT fenced area devoted to the perpetuation and welfare of the pronghorn antelope was advocated by Paul G. Redington, chief of Biological Survey of the U. S. Department of Agriculture, in his address before the meeting of the American Game Protective Association.

This species, which is a unique American animal and not closely related to the Old World antelope, was formerly even more numerous than the great bison herds that once roamed the plains of the West, but reckless hunting almost wiped it out. Although it is now rigidly protected, its numbers have been so far reduced that it has a hard time making headway against wolves, mountain lions and other predatory animals, not to mention poachers who snipe at it in defiance of the law. Some of the states have taken measures for the preservation of the pronghorn, but aside from the national parks there are no federal refuges. Dr. Redington is of the opinion that a national sanctuary on a large scale can be developed without infringing on the rights of the various states.

Dr. Redington expressed himself as frankly disappointed at the lack of progress in the development of the migratory game bird refuge system. A few separate steps have been taken, he said, notably the establishment of the great Mississippi sanctuary, but this country has not lived up to the obligations it has assumed in this matter. Agreement among sportsmen and other persons concerned in the duck problem must be reached in order to make progress possible. "The sportsmen and bird lovers of this country have come to a place where they must 'fish or cut bait' on the matter of federal refuges for migratory birds."

TRAFFIC SIGNS AND SIGNALS

TRAFFIC signs and signals should be made so simple and so uniform that guiding an automobile would become as automatic as walking. This is the difficult goal for traffic engineers set before the Highway Research Board in a report by Dr. Knight Dunlap, professor of psychology at the Johns Hopkins University.

"Drivers will never be trained to the point of an automatic, unreflecting 'stop' on the red light so long as other uses of red in signals are retained," Dr. Dunlap said. "Fatal accidents have occurred from use of red lanterns on road obstructions. But the more important factor in such cases is that the misuses of signals prevent the proper training of the motorist and are therefore conducive to accidents at other points. It is entirely feasible to do away with the use of red for all traffic signs not meaning 'stop'."

Many types of road signs lead to bad habits on the part of drivers, the psychologist pointed out. Frequent use of "dangerous curve" markers at gentle curves, for example, cause motorists to ignore such signs at points where the warning is needed.

Drivers hunting parking space in busy streets often put themselves and other people in danger because of the complex process involved in finding out where and how long they can park in a given street. A recent detailed examination of the parking signs about Washington streets was cited by Dr. Dunlap as showing how colors and shapes are used indiscriminately, so that they mean nothing definite, and how the words on signs are not standardized enough so that the motorist can grasp the idea with a minimum of reading.

By a system established in Baltimore the driver can see nearly a block away from a given place whether he can park there or not, and if so how long, and this system is proving itself sufficiently satisfactory to serve as a model in other cities.

Standardization is urgently needed in traffic signs and signals to increase safety, but bad standardization is worse than none. Before standards are established there should be experiments and investigations to establish facts about matters which have been too much subject to theory and guess.

NEWLY DISCOVERED COMET

THE first bright naked-eye comet of recent years has been found by an amateur astronomer in Australia, according to communications received here by the Harvard College Observatory, American clearing house for astronomical discoveries. The discoverer was not a professional astronomer, but an amateur star-gazer, J. F. Skjellerup, who once lived in South Africa, where he made previous cometary discoveries. Not only is the Skjellerup comet the brightest that has been seen recently, but it brings this year within one comet of the record of 1926, when eleven were observed, more than ever before. The new visitor is this year's tenth, so that it will be recorded in astronomical annals as comet 1927j. When he picked it up on Saturday, December 3, the comet was in the constellation Norma Euclidus, or "Euclid's Rule." This is a star group that is not visible to inhabitants of north temperate countries, but at Melbourne it is nearly overhead at certain times of the year. This month, an Australian would see it low on the eastern sky shortly before sunrise, so that its poor position, even for southern countries, probably accounts for the fact that it reached third magnitude before it

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was found. On a clear dark night the keen eye can see objects about as faint as the sixth magnitude.

The comet's exact position when found, expressed in the astronomical equivalents of latitude and longitude, was 16 hours, 12 minutes and 12 seconds right ascension, and 53 degrees 57 minutes south declination. It had a tail three degrees long, or about six times the apparent diameter of the full moon. However, as it was moving towards the sun, it will soon be invisible even in southern countries, as the glare of that brilliant body obscures even the brightest comets.

Just what may happen to the comet is problematical. To determine its orbit, at least three separate observations of its position must be made. Whether these can be obtained before the Skjellerup comet disappears in the sun's glare remains to be seen. If not, the object may be lost, as has happened in the past. In the summer of 1921, Dr. W. W. Campbell, director of the Lick Observatory of the University of California, was sitting in front of his house with some friends watching the sunset over the mountains. One of the party noticed a strange bright object in the gathering dusk just after the sun had descended below the horizon. As no known object of such brightness, which must have been first magnitude or more, was known in such a position, it is believed to have been a comet. The next night, however, it had vanished in the sun's rays, and was never seen again.

However, if all goes well with the Skjellerup comet it should go around behind the sun, and then reappear on the other side. If that is the case, it should turn up in the neighborhood of Aquila, the eagle, which is now seen in the western sky shortly after sunset, though without exact data on its orbit, any prediction of its behavior is most uncertain. After that it may mount still higher in the night sky, and so perhaps the coming months will be enlivened by the presence of a brilliant comet.

ITEMS

CHILDREN are not being born in Europe fast enough to keep the man power of the nations on the increase, and after only some 20 or 30 years more the western nations of Europe will have reached the peak figure of their population. These are the conclusions just announced by Dr. Swen Brisman, professor of political economy at the Commercial College of Gothenburg. In all European nations the birth-rate has declined since 1913, with the exception of the Netherlands, and even there the trend is now believed to be downward. Figures set by Dr. Brisman as the maximum to which European countries may attain before the tide of population starts to turn are as follows: France, present population in millions, 40.3, future, 42.0; Great Britain, present, 43.8, future, 49.0; Sweden, present, 6.1, future, 6.1; Norway, present, 2.8, future, 3.3; Denmark, present, 3.4, future, 4.3; Finland, present, 3.3, future, 4.7; Switzerland, present, 3.9, future, 4.4; Belgium, present, 7.7, future, 9.3; Netherlands, present, 7.4, future, 10.7; Germany, present, 62.6, future, 77.0; Italy, present, 40.0, future, 62.0; Spain, present, 22.0, future, 35.0.

AFTER years of painstaking scientific research an authoritative international agreement has been reached involving a single temperature scale, a fundamental standard of length and a consensus of opinion concerning the basis of the world's electrical units. The agreement took place at the Seventh International Conference on Weights and Measures, held recently at Paris, the United States being represented by George K. Burgess, director of the Bureau of Standards. The proposition of the United States to define the length of the international meter in terms of the wave-length of the red radiation from the cadmium lamp was also tentatively adopted, the final wording of the recommendation as decided on by the conference being an improvement on that submitted by the United States. Thus there is established a permanent natural standard of length, easily reproduced and capable of being used in the most precise measurements. The relationship between the international meter and the wave-length of red light from cadmium vapor is: one meter equals 1,533,164.13 waves.

RADIO engineers now have to find a way to prevent their transmitted waves from going around the earth, thus illustrating the great advances that have been made in radio in recent years. Not so long ago, their problem was to get the signals across a gap of a few thousand miles. Now they have a problem because the signals sometimes not only go the shortest way between the transmitting and the receiving stations, but also go around the long way, causing an echo. They may keep on going and travel around again and again, causing a series of echoes. This effect has been noticed in a series of experiments carried out at Geltow, recently, by E. Quaeck. Records were made of signals received from Rio de Janeiro. It was found that the signals were always accompanied by this echo, and sometimes by several of them. The significant thing was that when there was a series they were a multiple of a seventh of a second after the direct signal. As radio waves, which travel with the speed of light, take just a seventh of a second to encircle the globe, it seems to indicate conclusively that the series of echoes is caused by the waves going on around and around the earth many times.

BY holding a stop-watch on 10 busy three-year-old boys and girls, a psychologist at McGill University has found that a child of this age is usually interested in one thing for just about eight minutes. After that, some new amusement or occupation must be produced. Even when they are most absorbed, three-year-olds at home or at nursery schools cannot be expected to spend more than half an hour at one kind of occupation according to K. M. Banham Bridges, who describes the experiment in a report to the Pedagogical Seminary. Boys in the experiment liked best building with large bricks, and other occupations in which they could use the entire body freely. The girls preferred sitting at a table matching colors or fitting cylinders into different kinds of holes. The girls showed an interest in a wider variety of activities than the boys and their interest in a task lasted a little longer, the psychologist reports.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE BEGINNING OF WINTER

THOUGH the cold wave which has swept over the country recently has brought with it wintry temperatures, winter has not yet begun, according to the astronomer. Not until 3:18 P. M., on Thursday, December 22, does it actually start.

The event by which astronomers determine the start of winter is concerned with the sun. On the twenty-second it enters the sign of Capricornus. This is one of the ancient signs of the zodiac, the path through which the sun, moon and planets all move. Many centuries ago these signs coincided with the constellations after which they are named, but in the time since the motion of the earth called precession has moved them. Now the sun is actually in the constellation of Sagittarius, the Archer, when it enters the sign of Capricornus, the Sea-Goat. Not until January will it actually be in the constellation of the Sea-Goat.

But to the ordinary person, the feature that marks the winter solstice, as the beginning of winter is called, is not the entrance of the sun into an imaginary part of the sky. What is most obvious is that the sun is then farthest south. Each day at noon, when the sun crosses the meridian, it is as high in the heavens as it gets on that particular day. If you start in June and watch how high it is above the horizon then, you will find that it is at an altitude of 73 degrees from the middle of the United States. If it were 90 degrees, it would be overhead.

After the beginning of summer, the noon altitude of the sun gradually becomes less, until in December it is only 28 degrees above the horizon. At the winter solstice it reaches its lowest altitude and then starts to rise, continuing until next June.

Another consequence of the low altitude of the sun is that the day on which the winter solstice occurs is the shortest of the year. On the twenty-second the sun rises, along the parallel of 40 degrees north latitude, at 7:18 A. M., and sets at 4:38 P. M., so that only 9 hours and 20 minutes are provided on that day.

CONCERNING COMETS

THOUGH only a few of the stars visible in the sky exceed in brightness the Skjellerup comet, which is now near the earth and of naked-eye visibility, the comet is really an "airy nothing." Even if it should land on the earth, as it will not, it would probably not do any particular damage. Some comets have been bright enough to be seen in full daylight, and to stretch their tails half way across the sky. But even these have not contained enough material to make a first-class asteroid, or little planet, the largest of which are not over a hundred miles in diameter. It has been estimated that Halley's comet, one of the most famous of these visitors, contained about a twentieth of the material excavated in digging the Panama Canal. It has also been said that the brightness of Halley's comet would have been what it was if it were made up only of a dozen bodies as big as small marbles in a cubic mile of comet!

Even the head of a comet is transparent enough for stars to shine through it. Probably, as it approaches the sun, it consists of a clump of tiny meteorites, which is seen, if at all, by reflected sunlight. Then it is drawn closer to the sun by the latter's gravitational attraction, the tiny cometary particles having just about enough gravitational effect to hold the swarm together. Then it gets nearer the sun, and warmer. The heat causes gases that have been carried in the meteoric material to come out, carrying with them much finer particles, or dust. These are so small, that the light from the sun exerts a pressure on them and so they travel away from the sun, to form the tail. When approaching the sun, the tail is behind the comet, but after it has passed around the sun, and moves out into distant space again, the tail comes first, the head trailing along behind. Finally, it returns to pretty much the same state as when it entered the influence of the sun, but with some of its material lost to it forever.

The brightness of the comet when near the sun is partly reflected sunlight and partly a glowing of the gases in the tail under the influence of the rays of the sun. In this respect it is something like the aurora. The sun is sending out, besides visible light, numerous electrons, or "cathode rays." These cause a luminescence of various gases, when hightly rarefied, an experiment that can be duplicated in the laboratory. The very thin gases in the comet's tail, or in the upper atmosphere in the case of the aurora, are made to glow by these rays.

After the comet has passed the sun, it may go out into space to be lost to us forever. But many of the cometary orbits are ellipses, so that the comet returns again and again, in a period varying from a few years to many millennia. Sometimes the comet may approach within a short distance of one of the large planets, especially Jupiter. The great gravitational attraction of the planet will then put a considerable kink in its orbit, so that when it returns again near the earth it may be almost unrecognizable as the same comet. But the comet, being so light, has no appreciable effect on the planet.

INJURIES FROM CATHODE RAYS

INJURIES caused by cathode rays, streams of electrons projected from Dr. W. D. Coolidge's recently-invented tube, closely resemble burns due to overdoses of X-rays and are similarly stubborn about healing. This is indicated by experiments performed by Dr. Victor C. Jacobson and Dr. Kenneth C. Waddell, of the Albany Medical College, to be announced soon in the scientific journal, *Archives of Pathology*.

Rats were used as subjects of the experiments. The animals were wrapped in jackets of copper foil to pro-

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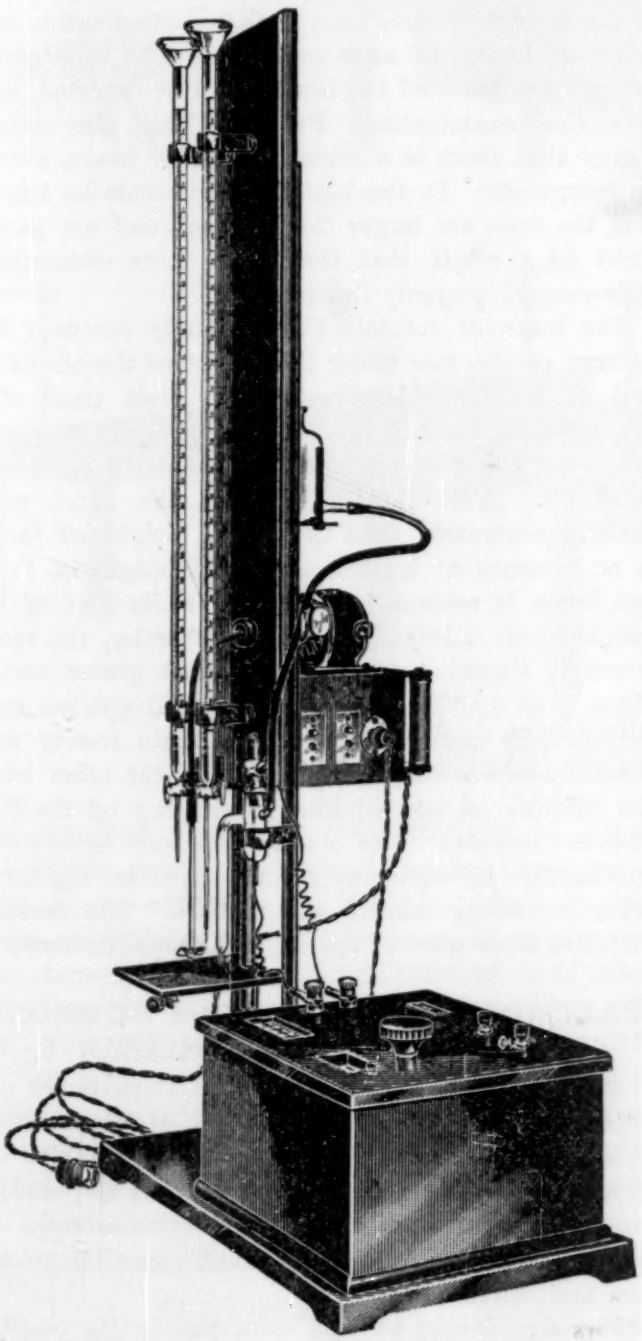

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tect them from being rayed all over, and only a spot about an inch in diameter on the upper abdomen was left exposed. They were left in front of the window of the apparatus for periods varying from one tenth of a second to six seconds daily for fourteen days, while others received only single rayings of from six seconds to a minute. Current was fed into the tube at three voltages, 100,000, 200,000 and 300,000 volts, respectively.

The first sign of effect by the cathode rays was in the change of hair color, from white to yellow. Then the skin appeared to be tender, and finally developed pronounced sores, which were very slow to heal. When the rats were chloroformed and the skin subjected to microscopic examination, the details of the damage resembled closely those of X-ray burns. The experimenters state that it now appears highly likely that X-ray burns are really due to cathode rays generated by the impact of X-rays on solid or liquid objects which they encounter.

EXPLORATIONS IN THE BAHAMAS

IN an effort to ascertain the origin of the pure limestone strata which are found in such mountain ranges as the Alps, the Rockies and the Appalachians, Dr. Richard Montgomery Field, of Princeton University, and Carl Breuer, of Locust Valley, N. Y., a junior in the department of geology, will spend their Christmas vacations off the west coast of the island of Andros, a hitherto geologically-unexplored district. Andros Island is in the Bahama group, 125 miles east of Florida and 175 miles north of Cuba.

The Princeton geologists believe that in this great marine flat, which is 300 miles long and 60 miles wide, where the water is never more than 25 feet deep, they will find now being reproduced conditions similar to those of Paleozoic times when the limestone was being formed by a sedimentation of calcium carbonate.

If the results of this preliminary survey indicate, as the Princeton geologists hope, that further study would be of scientific value from the geological point of view, it is planned to have a combined investigation of the geological and biological phenomena of this area. It is expected that Dr. William Beebe and Dr. Charles Fish, director of the Buffalo Society of Natural Sciences, an oceanographer, will cooperate in this work.

In making the preliminary survey, Dr. Field and Mr. Breuer will make use of diving helmets and undersea cameras which they have developed for such work. During Christmas vacation last year, Breuer, then a sophomore, made a study of marine formations off the coast of Bermuda.

While studying the structure of the Appalachians in 1916, Dr. Field first began his investigations into the origin of the pure unfossiliferous limestone found in this range. He came to the conclusion that it might be possible to find conditions suitable for the formation of the limestone in the lagoons formed by coral reefs, but later decided that it would be necessary to study sedimentation over a greater area than the lagoons would afford. He believes that the conditions off the west coast of Andros are unduplicated anywhere else in the world.

THE BRAINS OF NIKOLAI LENIN AND ANATOLE FRANCE

THE brain of Nikolai Lenin, examined by request of the Soviet Government, shows marked characteristics of genius, according to Professor Oscar Vogt, director of the Kaiser Wilhelm Institute for Brain Research. Professor Vogt found in the Russian leader's brain evidence to support the theory that certain parts of the brain govern certain specific mental functions. This theory has lately been attacked by experiments on apes, indicating that if one area of the gray matter is destroyed another may take up its work. Two hundred fields of localization were found in the brain of Lenin and definite areas of the same type have been found in examination of hundreds of brains of apes and men. The differences between these parts of the brain could be detected, he said, upon close examination. Professor Vogt also upheld the theory that there is a criminal type of brain, which can be recognized. In the brains of criminals he has found that the cells are larger than normal, and are packed so tight as a result that the nerve fibers connecting the cells can not properly develop.

The brain of Anatole France, lately deceased French literary genius, was under the weight of the normal brain and of decidedly less avoirdupois than those of such celebrities as Lord Byron and Schubert, the musical composer, according to a report just submitted to the French Academy. This merely reaffirms the often repeated medical contention that the actual weight of the brain is no measure of intelligence. The weight of the average brain is around 1,360 grams, while that of France weighed only 1,190. The brain of Cuvier, the zoologist, however, tipped the scales at 1,829 grams and Lord Byron's at 1,807. The commonly held opinion that the convolutions and wrinkles of the brain testify superior intelligence was amply confirmed, on the other hand, by the furrows on the thinking mechanism of the dean of French literature. The convolutions were separated from one another by deep and flexuous grooves, together with many secondary fissures and notches. The frontal and occipital lobes were of specially complex character.

CALCIUM AND ALUMINIUM COMPOUNDS FOR CHICKEN SARCOMA

DR. MARGARET R. LEWIS, of the Department of Embryology of the Carnegie Institution of Washington, and Dr. Howard B. Andervont, of the Johns Hopkins University, have succeeded in establishing that the unidentified organism that causes the Rous chicken sarcoma can be rendered inactive by means of small quantities of aluminium and calcium salts.

The significance of this work lies in its possible application in the treatment of human cancer. An immense amount of research will have to be done before any such result is likely to ensue, but these recently learned facts point the way to a new direction for cancer research in other laboratories. The chemicals that have been used in the treatment of cancer in the past have been highly toxic in character with a strong tendency to injure other parts of the body as well as the cancer cells. If it is

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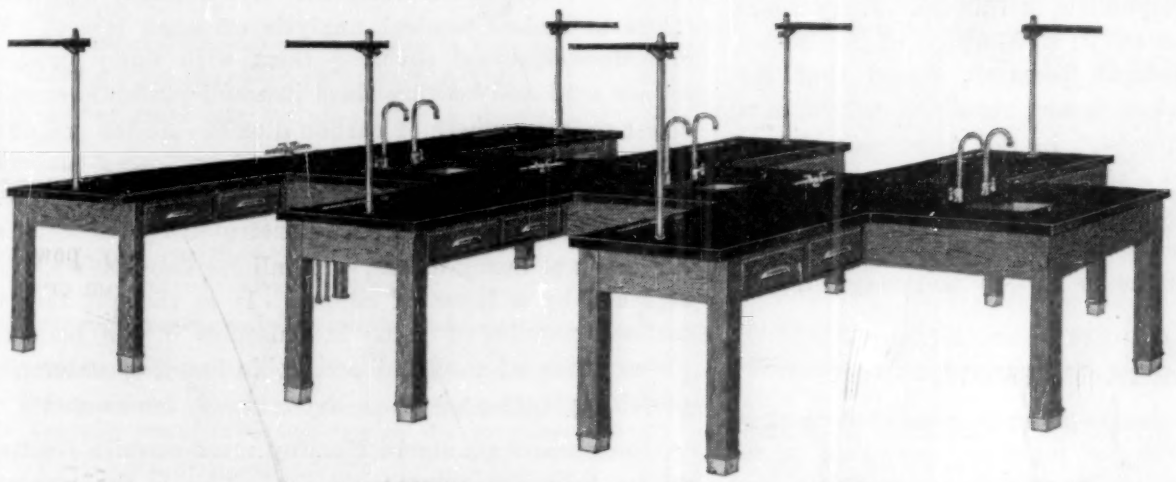

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found that calcium and aluminium compounds, either given by mouth or injected into the blood stream, will have an adverse effect on cancer in chickens, it may lead to results of great benefit in treating human cancer because these compounds are more or less inert with little capacity to harm body tissues.

"While the primary tumor of this particular type of malignant chicken cancer," explained Mrs. Lewis, "differs in some respects from those found in human beings and higher animals, the secondary tumors or metastases, as they are called, are similar to the malignant sarcoma of man. The chicken tumor behaves quite as those of other kinds of animals in that it invades the tissue, develops metastases, leads to the death of the animal and can be transferred by means of transplantation from one animal to another of the same species, though not, of course, to an animal of a different species.

"The chicken tumor also resembles certain other diseases in that it is caused by a still unidentified agent that behaves like the so-called filterable viruses responsible for smallpox, rabies and encephalitis in rabbits. Many years ago Dr. Peyton Rous and Dr. J. B. Murphy, of the Roekefeller Institute for Medical Research, found that the causative agent of chicken tumor remained active in a filtrate, a glycerine extract or in the dried material of the tumor itself. It was also established by these workers that inoculation of these agents not only produced the disease, but that if the animal recovered from the tumor it was more or less immune to further inoculation of the tumor virus."

CHOLERA IN INDIA

INDIA has had more deaths from Asiatic cholera than all the rest of the world put together, according to reports just issued by the health section of the League of Nations. The total for 1926, the last year for which there are complete returns, showed 72,859 deaths, a figure soaring high above that of all other countries from which reports are received or can be estimated.

Press dispatches reporting an unusual prevalence of cholera in India at the present time appear to be unfounded in the light of epidemiological information received here. Some 3,700 cases are mentioned as occurring the week of November 19, but considering that there were over 5,000 cases in the province at the end of September, it would seem that rumors of a severe epidemic have been exaggerated.

It should be remembered that this highly fatal disease has existed since very early times around the mouth of the Ganges River. It was not known to the outside world until the British occupation. Since this time, however, the increasing facilities of modern travel have carried it on various occasions to different parts of the world.

The first recorded excursion of this dangerous infection beyond its native haunts took place in 1816. It traveled slowly in those days of sailing vessels but managed to extend its range to the rest of Asia and to Africa. In 1826 it broke loose again, reaching as far as Europe and America. Twenty years later it spread to the uttermost parts of the earth, killing 150,000 people in France alone. It has flared up in world-wide epidemics three times since. The last, which occurred in 1902, has its start from the gathering of some 400,000 pilgrims at Mecca.

The cholera bacillus is carried in drinking water from regions where the disease is prevalent. Infection can only take place by swallowing the germ, much as typhoid fever is transmitted. This means that Asiatic cholera can be brought under control by sanitary measures and for this reason has never gained a serious foothold in advanced countries during recent years.

ITEMS

INSECTS made of metal, true to the originals in the last minute details of structure, are produced by a process discovered by Dr. N. D. Zelinsky, a German chemist. As a matter of fact, the insects themselves are metallized through a replacement of their original substance with the metal, just as the details of wood or leaf structure are replaced with stone in petrifactions. The process was discovered by a quasi-accident. Dr. Zelinsky had undertaken to make chemical analysis of some insects. The procedure involved covering them with finely powdered copper oxid and heating them in small platinum crucibles under an atmosphere of carbon dioxid. At the end of the treatment he found to his astonishment that he had a collection of perfect copper insects, for the outer parts of their body-shells had been penetrated by the metal and the original horny chitin, with all its fine markings, was replaced by a layer of copper. It is thought that this method may be of value in museums in the permanent preservation of rare and perishable insect specimens, and possibly plants as well.

GOOSEBERRY plants in Norway must acquire resistance to an American fungus—or die. This is the conclusion of Dr. Ivar Jorstad. The fungus in the case is the one that causes gooseberry mildew. Until a quarter of a century ago it was unknown outside of America. Then it was introduced into Europe and has now spread to most European gooseberry regions. The fungus has long been known in America, but has never done much harm to American berries. Evidently they had acquired a certain amount of resistance to this parasite. When the fungus reached Europe it found itself in a most congenial environment. The varieties of gooseberries there had never been exposed to the mildew in the whole process of evolution. Practically all of them were very susceptible. The fungus spread rapidly from farm to farm. Behind it the gooseberry plantations were ruined. The agricultural authorities of Norway prohibited further importation of gooseberry plants. They also established quarantine inside of Norway in an effort to prevent the transportation of plants from the infected to non-infected areas. In Dr. Jorstad's opinion this action was taken at least two years too late. Dr. Jorstad summarizes his observations as showing the impracticability of preventing the spread of a plant disease of this sort in the absence of some natural, geographical feature to limit its spread. He considers it only a matter of time now before mildew will be prevalent in the few regions of Norway where it has not already been found.

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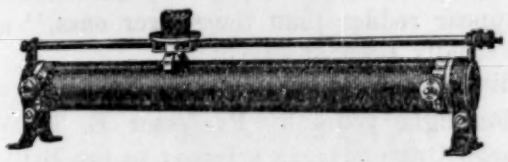

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENTIFIC ADVANCES DURING 1927

ASTRONOMY

An amateur astronomer named Blathwayt, at Braamfontein, South Africa, discovered a new comet on January 13.

An amateur astronomer, William Reid, of Rondebosch, South Africa, discovered a new comet on January 26.

The Pons-Winnecke comet, which made one of its sexennial visits to the earth's neighborhood, was detected on March 3 by Dr. George Van Biesbroeck, of the Yerkes Observatory, Williams Bay, Wis. It came within 3,500,000 miles of the earth on June 27, closer, with one exception, than any comet had been known to come in the past.

A new comet was discovered on March 10 by Dr. Carl L. Stearns, of the Van Vleck Observatory of Connecticut Wesleyan University.

The Grigg-Skjellerup comet was discovered on March 30 by Dr. George Van Biesbroeck, of the Yerkes Observatory.

An Australian justice of the peace and amateur astronomer, Walter F. Gale, discovered a new comet on June 7.

Schaumasse's periodic comet was observed on its return on October 4 by Professor Van Biesbroeck, of the Yerkes Observatory, and possibly by Gerald Merton, of the British Royal Observatory, a little earlier.

Encke's comet, a periodic visitor, was found on November 12 as it came near the earth again, by Professor George Van Biesbroeck, of the Yerkes Observatory.

A naked-eye comet visible in both the northern and southern hemispheres was discovered on December 3 by J. F. Skjellerup, Australian amateur, and was visible just before Christmas.

A new star was located in the Milky Way by Dr. Max Wolf, of the Heidelberg Observatory in Germany.

A comet and a nova, or new star, were discovered within three days by two German astronomers, Drs. A. Schwassman and Wachmann.

Professor Joel Stebbins, of the University of Wisconsin, announced the discovery that the satellites of Jupiter always keep the same side turned toward their parent planet, just as the moon does toward the earth.

An eclipse of the sun on June 29, visible in England and Norway, was seen at certain points along the path of totality by astronomers from the British Royal Observatory and the Hamburg Observatory in Germany, though American astronomers in Norway were unable to see any of it on account of cloudy weather.

The aid of the Canadian Mounted Police, Catholic missionaries to the Eskimoes, fur trappers and others was asked by Dr. Willard J. Fisher, of the Harvard College Observatory, in observing the total eclipse of the moon on June 15.

Discovery of just how the solar radiation varies was announced by Dr. C. G. Abbot, of the Smithsonian Institution. Many large sunspots were observed, and magnetic storms on the earth took place in apparent conjunction with them.

The possibility that stars may be liquid was advanced by Professor J. H. Jeans, English astronomer.

Basalt, a rock common on the earth, is not present on the surface of the moon, Dr. Fred E. Wright, of the Carnegie Institution, told members of the National Academy of Sciences.

"The sun and the near-by stars may be in a vast cloud of cosmic 'dust,'" said Professor Edward S. King, of the Harvard Observatory, "thus causing the more distant stars to appear redder than the nearer ones," an effect that has actually been observed.

The radius of the universe was estimated as one hundred million light years by Professor E. T. Whitaker, of Edinburgh University, in a report to the British Association for the Advancement of Science.

In the hands of amateur astronomers in all parts of the world, his invention of the spectrohelioscope may go far towards solving outstanding solar mysteries, Dr. George Ellery Hale, honorary director of the Mt. Wilson Observatory, declared.

A 60-inch reflecting telescope, the largest in the southern hemisphere and the third largest in the world, was ordered for the new South African station of the Harvard College Observatory, which will replace the former station at Arequipa, Peru.

The solar wave-lengths in the unexplored regions of the spectrum were mapped by the U. S. Bureau of Standards in cooperation with Allegheny Observatory.

The largest disk of optical glass ever cast in the United States was made by the U. S. Bureau of Standards, the reflecting telescope blank being of borosilicate crown glass, 70 inches in diameter and 12½ inches thick.

PHYSICS

A new theory of the mechanics of atoms was enunciated by the Swiss physicist, Schrodinger, which, in brief, holds that electrons and other units of matter are wave systems like ordinary light and X-rays.

The 1927 Nobel prize for physics was awarded jointly to Professor Arthur H. Compton, of the University of Chicago, and Dr. C. T. R. Wilson, of the University of Cambridge, for their researches on X-rays and radium radiation.

The tercentennial of the death of Isaac Newton was celebrated by scientists all over the world.

Dr. Dayton C. Miller, of the Case School of Applied Science, at Cleveland, Ohio, repeated experiments that may show that the earth is drifting through the ether.

Sound-waves vibrating far too rapidly to be heard produced such curious effects as the emulsion of a candle in water, Professor R. W. Wood, of the Johns Hopkins University said, in describing to the National Academy of Sciences work which he had performed in collaboration with Alfred L. Loomis.

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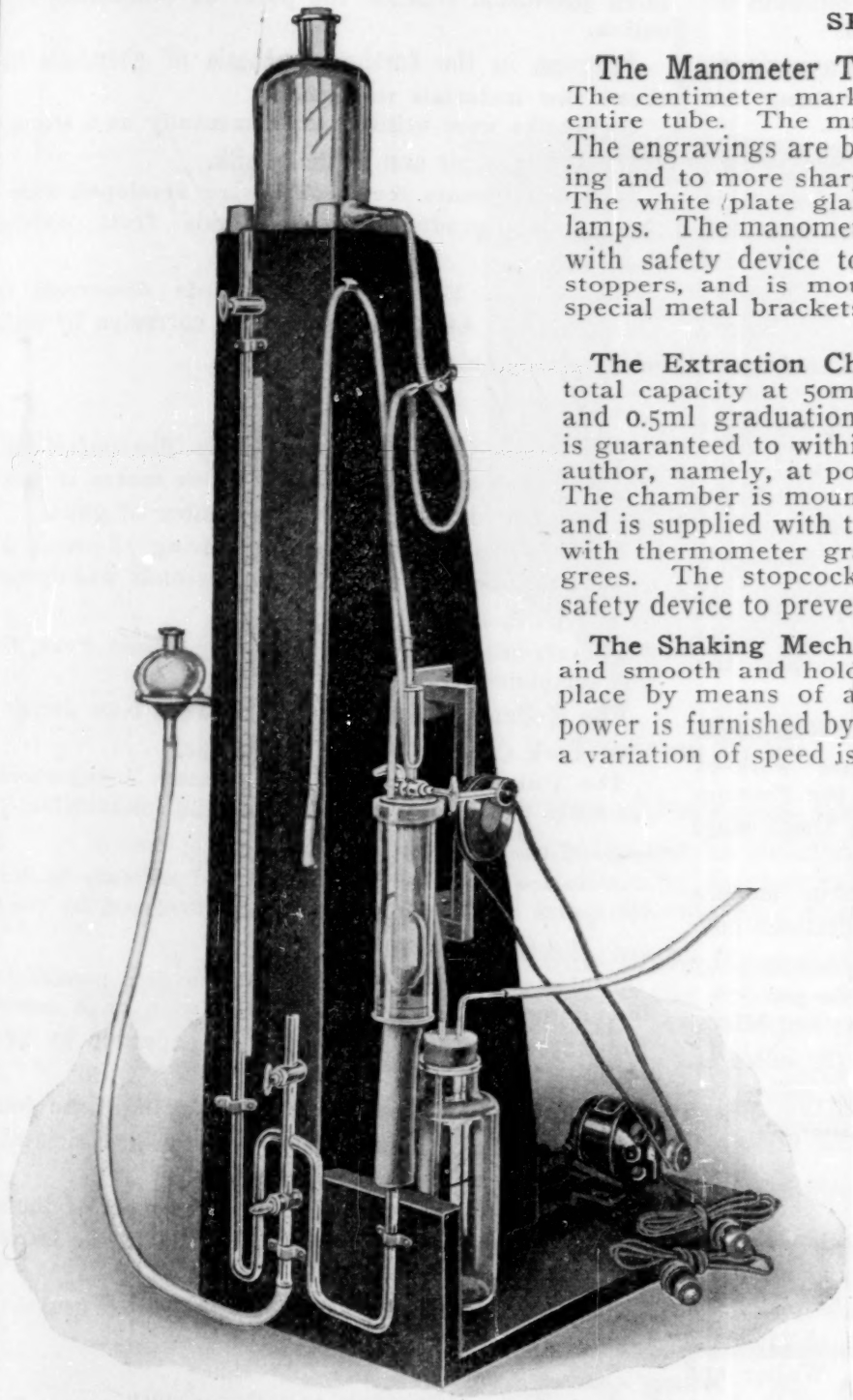

SPECIFICATIONS

The Manometer Tube: The tube is graduated in mm. The centimeter marks encircle the circumference of the entire tube. The mm subdivision marks in semi-circles. The engravings are backed by a white plate for easy reading and to more sharply accentuate the mercury meniscus. The white plate glass is backed by two bright electric lamps. The manometer tube has three stopcocks equipped with safety device to prevent removal or falling out of stoppers, and is mounted firmly but easily removed by special metal brackets.

The Extraction Chamber: This part is graduated for total capacity at 50ml with points above the bulb at 2ml and 0.5ml graduations. The accuracy of the graduation is guaranteed to within the limits of error specified by the author, namely, at points 2ml and 0.5ml to within .002ml. The chamber is mounted in a water jacket of heavy glass and is supplied with two special rubber stoppers, complete with thermometer graduated from 15 to 35° C in 1° degrees. The stopcock of the chamber is equipped with safety device to prevent removal or falling out of stoppers.

The Shaking Mechanism is all ball bearing type silent and smooth and holds the extraction chamber firmly in place by means of a specially constructed clamp. The power is furnished by a motor of ample horse power, and a variation of speed is regulated by a Rheostat.

05100: Van Slyke Constant Volume Blood Gas Apparatus as above described, mounted on polished oak support 40 inches high, 12 inches wide and 21 inches deep, with clamp for attaching to table and all glass parts, including leveling aspirator, bottle and wash bottle, necessary rubber tubing, switches for power and light motor and shaking device, complete ready for use but without pipettes.

Price

Each **$127.50**

05101: Ditto but without lighting equipment, each **$115.00**

05102: Ditto but without lighting equipment or motor and speed control Rheostat, each. **$100.00**

The motors supplied with the above apparatus can be operated on AC or DC Current for 110 volts, 220 volt motors can be furnished on special order.

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Cathode rays from the tube recently invented by Dr. W. D. Coolidge, of the Research Laboratory of the General Electric Company, have been found to be like sunlight in their power to give certain substances the quality of preventing rickets.

An instrument known as the thermionic microammeter, able to measure one five-billionth of an ammeter, was developed by the laboratory of the General Electric Co., at Lynn, Mass.

The grid glow relay, invention of D. D. Knowles, Westinghouse engineer, which operates on a billionth of a watt of electrical power, was demonstrated.

Discovery of a new electrical insulator was announced by Dr. Abram Joffe, a Russian scientist visiting the United States.

A highly successful process of television, by wire and radio, the development of the Bell Laboratories under the direction of Dr. Herbert E. Ives, was demonstrated on April 7.

The televox, an apparatus by which the telephoned note of a tuning-fork can be used to extinguish lights, start and stop electric fans, and operate other devices, was exhibited by its inventor, R. J. Wensley.

The non-magnetic ship Carnegie was overhauled preparatory to a lengthy scientific cruise to begin next year.

Metal shrinks when it is magnetized, Professor S. R. Williams, of Amherst College, stated.

The conclusion that nebulium, the strange "element" supposed to exist in such bodies as the great cloud of glowing gas in the star group of Orion, is merely oxygen and nitrogen was reached by Dr. I. S. Bowen, of the Norman Bridge Laboratory of Physics.

Dr. Paul R. Heyl, of the U. S. Bureau of Standards, announced the determination after three years' work of the Newtonian constant of gravitation as the fraction 6.664 over a hundred million; a value ten times more accurate than the previously accepted value.

The "quantum," the "atom" of which modern physicists suppose that light and other radiations consist, may be divided was indicated by experiments by Dr. A. J. Dempster, of the University of Chicago.

The wind velocity of the hurricane that wrecked Miami on September 18, 1926, was determined as 132 miles an hour, which was stated to be the highest on record, by Benjamin C. Kadel of the U. S. Weather Bureau.

Chemistry

Experiments by H. S. Cooper, of Cleveland, Ohio, showed that the light-weight metal beryllium or its alloys is suitable for airship frames and light-weight pistons.

The new chemical element rhenium was obtained in pure form by its original discoverers, Drs. Walter and Ida Noddack.

Metallic vanadium was obtained for the first time by J. W. Marden and M. N. Rich, of the Westinghouse Lamp Co.

A record making deposit of borax, in the form of a new mineral called rasorite, was discovered in California by C. M. Rasor.

Professor David I. Macht, of the Johns Hopkins University, announced that polarized light speeded the growth of certain plants and had other effects on life.

That the germs of tuberculosis contain a previously unknown compound, a phosphorous-containing fat, was discovered by Professor R. J. Anderson, of Yale University.

Making of synthetic rubber from coal on a commercial scale was announced by the German chemical trust.

Electroplating of rubber from latex or colloidal solutions of rubber was developed upon an industrial scale.

Hydrogenation of coal to produce liquid fuels resembling petroleum reached the point of commercial application.

Progress in the further synthesis of chemicals from cheap raw materials was made.

Cornstalks were utilized experimentally as a source of cellulose for paper and artificial silk.

New denaturants for alcohol were developed, some of them being produced by synthesis from petroleum products.

The U. S. Bureau of Standards discovered that duralumin can be protected against corrosion by coating with pure aluminum.

Engineering

The U. S. Army developed a new fire-control instrument for anti-aircraft artillery, which makes it possible for one man to aim any desired number of guns.

A new 3-inch anti-aircraft gun firing 15-pound shells at the rate of about one every two seconds was developed by the U. S. Army.

The six-mile Moffat tunnel under James Peak, Colo., was completed.

The Holland vehicular tunnel between New Jersey and New York City was opened to traffic.

The United States Steel Corporation inaugurated an extensive program of research into the fundamental problems of the industry.

A device for detecting one part of mercury in 20,000,000 parts of the atmosphere was developed by the General Electric Company.

Diphenyl oxide, a white chemical with a powerful odor like geraniums, was experimented with as a substitute for water in steam boilers, in an endeavor to increase their efficiency.

More durable paper currency resulting from tests of the U. S. Bureau of Standards resulted in estimated savings of one million dollars a year.

An acoustical plaster which absorbs most of the sound falling upon it was developed by the U. S. Bureau of Standards.

Methods of making low-cost roads of gravel, sand and clay were developed.

Geology and Geography

Scientists of twenty-five nations, meeting at Prague, passed resolutions recommending an international cooperative study of "ocean deeps."

Floods in the lower Mississippi Valley and in New England were the worst that had ever been recorded.

That the Mississippi floods may be due to the gradual sinking of the lower valley of the river, closer and closer to sea-level, was suggested by Dr. David E. White, geolo-

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gist of the National Research Council and the U. S. Geological Survey.

Disastrous tornadoes struck Louisiana, Mississippi, Texas, Oklahoma, Illinois, Arkansas, Kansas and Missouri; St. Louis was particularly damaged.

Large quantities of oil may be deposited below the bottom of the sea, said Dr. Parker D. Trask, of the American Petroleum Institute.

Discoveries of potash salts in Texas and New Mexico thick and rich enough for mines were discovered through test borings made by the U. S. Geological Survey.

Seven thousand square miles in southeastern Alaska were surveyed by aerial mapping through the cooperation of the Navy and the U. S. Geological Survey.

Two large areas in Alaska, totaling 7,800 square miles, were explored by scientists of the U. S. Geological Survey, discovering and mapping a high mountain region hitherto unknown and finding a volcano in eruption.

A great earthquake on May 22 in the Kansu province in interior China was announced to the world on the following day by Science Service, in cooperating with the U. S. Coast and Geodetic Survey and the Jesuit Seismological Association, though it was not for many weeks later that actual reports from the devastated region reached civilization.

Other severe earthquakes during the year that were immediately located by the cooperation of these three bodies included those in Chile on April 14 and November 14; Japan, March 27; Alaska, on October 24, and California on November 4.

The heat of Kilauea, the world's largest volcano, was measured by means of borings made in its floor by Dr. T. A. Jaggar, director of the Hawaii Volcano Observatory.

Biology

A ten-million dollar war was waged against the European corn borer in the Corn Belt states by the Department of Agriculture and declared successful.

Three botanists, Dr. A. B. Stout, Dr. Ralph McKee and E. J. Schreiner, announced the development of a fast-growing hybrid poplar to meet the demands for wood pulp.

Cells, usually assumed to be short-lived, were found still living in the heartwood of redwood trees a century old, it was reported by Dr. D. T. MacDougal, of the Carnegie Institution of Washington, and Dr. G. M. Smith, of Stanford University.

Small amounts of copper were found to make low-grade muck lands highly productive, according to E. L. Felix, of Cornell University.

The Tennessee State Supreme Court, in a decision on the appeal in the famous Scopes case, declared the anti-evolution law constitutional, but so worded its decision as virtually to nullify the law. John Scopes was excused from paying the fine levied against him for violating the statute, because of an error on the part of the judge presiding at his trial.

Efforts made in thirteen states to pass anti-evolution statutes were unsuccessful.

X-rays applied to the reproductive cells of animals and plants were found to speed up the rate of evolutionary change over a thousand per cent. This work was done on fruit flies by Professor H. J. Muller, of the University of Texas, and on tobacco plants by Professor T. H. Goodspeed and Professor A. R. Olson, of the University of California.

Natural evolutionary changes in shell-fish within sixty years, producing distinctly recognizable animal varieties in a lake in Wisconsin, were reported by Dr. Frank C. Baker, curator of the museum of natural history of the University of Illinois.

Chemical affinities between the milks of related animals were discovered by Professor H. R. Marston, of the University of Adelaide.

Eggs of the marine worm, Nereis, were fertilized without fathers, by the use of an electric current, by Ware Cattell, of Memorial Hospital, New York City.

Dr. Barnett Sure, of the University of Arkansas, has shown by experiments with rats that a poorly nourished mother, whose bodily stock of vitamin B is subnormal, becomes unable to pass along this necessary food element to her nursing offspring.

The female sex hormone, or gland essence that causes typically feminine reactions and development in animals, was discovered in male animals as well as female, by Dr. Otfried O. Fellner, of Vienna.

The tuberculin testing of fowls to weed out avian tuberculosis was advocated by Dr. John R. Mohler, chief of the U. S. Bureau of Animal Industry, at the Third International Poultry Contest held at Ottawa, Canada.

Mathematic studies of athletic records show that the one for the 880-yard run should be most easily broken, according to the statement of Dr. Earle R. Hedrick, of the University of California.

Dr. Raymond Pearl, director of the Institute for Biological Research at the Johns Hopkins University, announced a theory based on laboratory observation of yeast, bacteria and fruit flies, that biological and human populations rise and fall in accordance with a universal law.

Congress passed a bill to provide for the collection and care of a herd of the nearly extinct Texas longhorn cattle in the Wichita National Forest, Oklahoma.

A program for the scientific study and administration of the great elk herds of the Yellowstone region was planned by a cooperative committee of the national, state and private bodies interested.

The First International Congress of Soil Science was held in Washington in June and attracted scientists from many foreign countries.

A serious plague of mice occurred in Kern County, Calif., during January and February.

A new mosquito poison based on formaldehyde and said to be the most efficient yet devised, was announced by E. Boubaud, of the Pasteur Institute, of Paris.

Rediscovery of the straight-billed reed runner, a bird of Uruguay first noted by Darwin in 1831, of which all trace had been lost for nearly one hundred years, was made by C. C. Sanborn, of the Captain Marshall Field South American Expedition of the Field Museum.